April 1994 Issue #32

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Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

in this issue

features

user's report

departments

Custom Callsigns

The FCC in December proposed giving amateurs the ability to choose their own callsigns, once a new automated processing system has been implemented at the Commission's Private Radio Bureau. Under the so-called "vanity callsign" proposal, hams would be required to file a form and pay a fee to apply for an available callsign.

The FCC said that callsign selection by new hams was not yet feasible, but left that issue open for possible future discussion. The new automated system may eventually allow for individuals to check on the availability of callsigns and for electronic filing of license applications.

Trustees of club and military recreation stations would also be eligible for the new program. An earlier rule establishing a callsign administrator program for club and military stations was canceled after never being implemented. The action took place during the first meeting under new FCC Chairman Reed Hundt. *TNX San Gabriel Valley Radio Club's "The Loudspeaker," January 1994.*

Examiners Busted

The FCC has suspended the accreditation of several Southern California Volunteer Examiners following a three-month investigation. The Commission also invalidated the amateur licenses and license upgrades of 21 people. The testing sessions in question took place in the Los Angeles area in June and August of 1993. Both involved the ARRL and W5YI VECs.

Details are still sketchy as this goes to press, but there are indications the investigation could be turned over to the Department of Justice for further inquiry. Should the Justice Department seek prosecution on fraud charges, a lot of people could face heavy fines or jail time as a result.

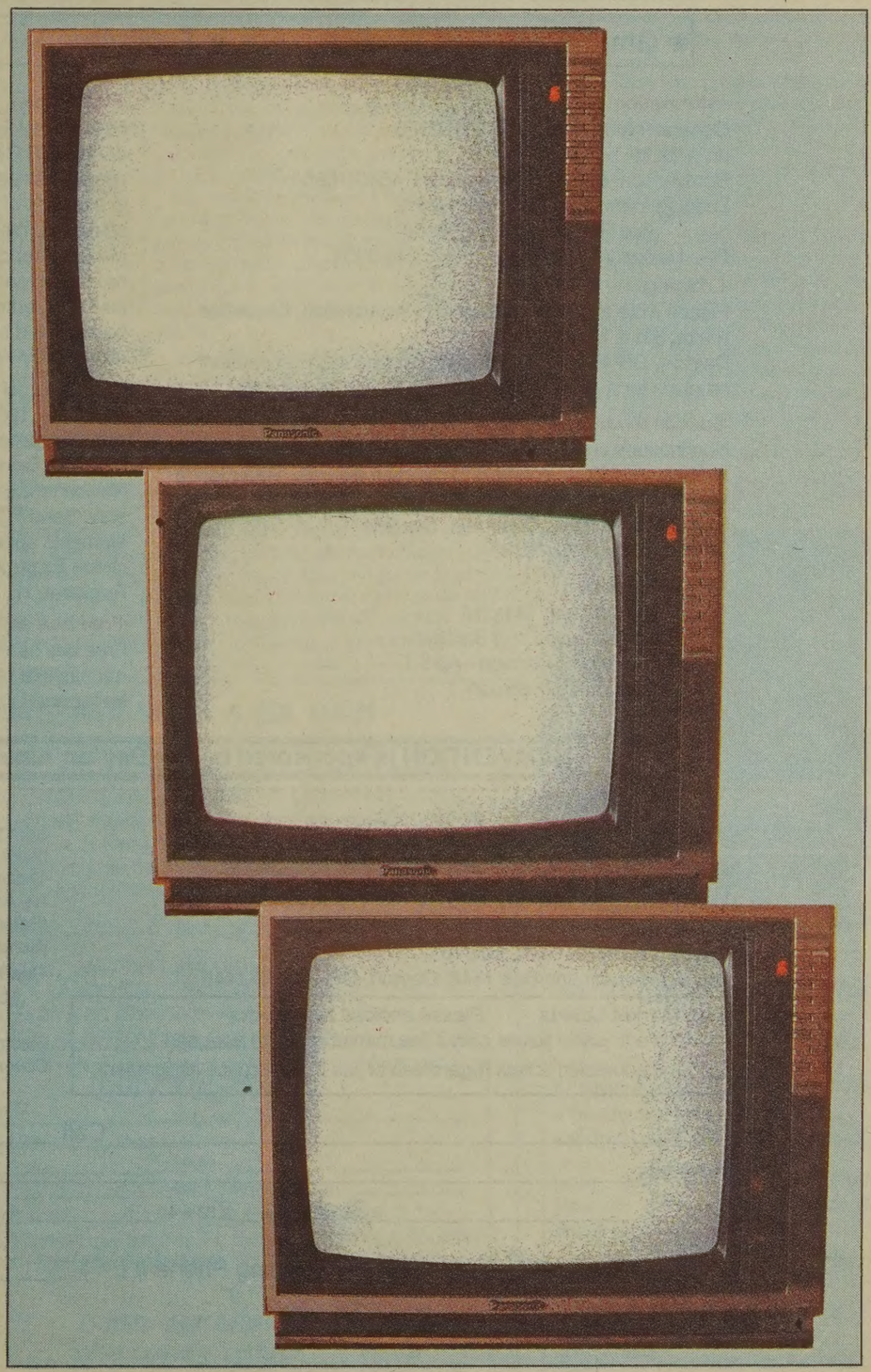
FCC Personal Radio Branch Chief John B. Johnston W3BE commended both the ARRL and the W5YI group for their joint cooperation in uncovering the irregularities in the L.A. testing sessions. He also praised them for their quick action in suspending the Volunteer Examiners believed to be involved. *TNX Westlink Report, No. 664, December 31, 1993; ARRL; and Newsline.*

Digital Hams

Anyone interested in digital communications is invited to submit a formal paper for the 1994 ARRL National Digital Conference to be held August 19-21, in Bloomington, MN. The theme for this year's conference is: "Digital Communications—Amateur Radio of Today . . . and the Future."

Presentation at the conference is not required for publication. Papers are due by June 20 and should be submitted to Maty Weinberg, ARRL, 225 Main Street, Newington, CT 06111; or via Internet at lweinber@arrl.org. A schedule for presentation of papers will be available in early July. *TNX Mike Stapp KEØWW.*

Slay the TVI Dragon!



Television Interference or TVI can be a tangled mess for ham radio operators. Learn how to operate in harmony with your neighbors' TV. Turn to "Preventing Television Interference" on page 8. (Photo by David Cassidy N1GPH.)

DAYTON hamvention® '94

April 29, 30 & May 1, 1994

General Chairman, Dave Grubb, KC8CF — Asst. General Chairman, Ken Allen, KB8KE

✷ Giant 3 day Flea Market ✷ Exhibits ✷ Activities for the Non-Ham

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General Information: (513) 276-6930
or, write to
Hamvention, Box 964, Dayton, OH 45401-0964
Lodging Information: (513) 223-2612
(No Reservations by Phone)
Flea Market Information: (513) 276-6932

Lodging

Please write to **Lodging, Dayton Hamvention, Chamber Plaza, 5th & Main Streets, Dayton, OH 45402-2400** or refer to our 1993 Hamvention program for a listing of hotel/motels in the Dayton area.

Special Awards

Nominations are requested for Amateur of the Year, Special Achievement and Technical Excellence awards. Refer to the Hamvention Program for nomination form or contact Hamvention Awards Chairman, Box 964 Dayton, OH 45401-0964.

1994 Deadlines

Award Nominations: March 1
Advance Registration and Banquet
USA - April 8 Canada - April 1
Flea Market Space: February 1

Flea Market

Flea Market Tickets (valid all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. A maximum of 3 spaces per person (non-transferable). Electricity is available in a portion of the last Flea Market row for $40 additional per space. Rental tables and chairs are not available in the Flea Market. Vendors ***MUST*** order an admission ticket when ordering Flea Market spaces. Please send a separate check for Flea Market space(s) and admission ticket(s). Spaces will be allocated by the Hamvention committee from all orders received by February 1. Please use 1st class mail *only*.

Notification of Flea Market space assignment will be mailed by March 15, 1994. Checks will not be deposited until after the selection process is complete.

License Exams

Novice thru Extra exams scheduled Saturday and Sunday only. Send FCC form 610 (Aug 1985 or later) - with requested elements shown at top of form, copy of present license and check for prevailing rates (payable to ARRL/VEC) to Exam Registration, 708 Mapleside Dr. Trotwood, OH 45426

Free bus service

Free bus service will be provided between Hamvention and our satellite parking areas. In addition, some motels may offer transportation to Hamvention.

HAMVENTION Is sponsored by the Dayton Amateur Radio Association Inc.

Advance Registration

Enclose check or money order for amount indicated in U.S. dollars and type or print your name and address clearly.

Make checks payable to:
Dayton HAMVENTION Mail to -
Dayton Hamvention Box 1446, Dayton, OH 45401-1446

Flea Market tickets *Please enclose two checks*
❑ Send admission tickets **only** if flea market space(s) assigned.
❑ Send admission tickets **regardless** of flea market space assignment.

		How Many	
Admission (valid all 3 days)	_____	@ $11.00*	$_____
Grand Banquet	_____	@ $22.00**	$_____
Alt. Act. Luncheon (Saturday)	_____	@ $8.50	$_____
(Sunday)	_____	@ $8.00	$_____
Flea Market ‡ (Max.3 spaces)	_____	$30/1 space	
	_____	$60/2 adjacent	
	_____	$150/3 adjacent	$_____
Electricity	add _____	$40.00/space	$_____
Covered tent	_____	$215.00 ea.	$_____
		Total	**$**_____

Name _____ Call _____

Address _____

City _____ State _____ Zip+4 _____ – _____

Daytime Phone # ( ) _____ Evening Phone # ( ) _____

* $14.00 at door
**$24.00 at door, if available
‡ Admission ticket must be ordered with flea market tickets

QLF

by Wayne Green W2NSD/1

Challenges . . .

Just because you may be relatively new to amateur radio doesn't mean that you can't have fun doing some pioneering. And there's plenty of pioneering that needs to be done. The time was when virtually every new development in communications started with radio amateurs. In recent years we've dropped the ball, and this has some of us worried that our franchise could be terminated.

I've explained in the past how Jack Babkes W2GDG came up with the idea for narrowband FM back in 1946. He parlayed that brainstorm into a fortune. That's about all we use on VHF these days. Another ham invented single sideband. Another came up with slow-scan TV, and so on. I was lucky enough to be around in those days and to be one of the pioneers helping these new modes get popular.

So what challenges have we today? Well, we're still creeping along on the high frequencies with packet. We need to goose that up to at least 9,600 baud, complete with error correcting. We need to get busy with digital voice, complete with data compacting algorithms. And let's speed up our slow-scan TV while we're at it.

You have the same 168 measly hours a week that I have, so what are you doing with them? Are you reading and educating yourself or are you watching TV, going to the movies, and rag-chewing? Or are you addicted to watching ball games?

When I discovered RTTY back in 1949 I got busy learning all I could about it. There wasn't much written then, so I learned from John Williams W2BFD. I had to build all my own equipment, but that helped me learn. The next thing I knew I was publishing a RTTY journal. Then I wrote a book, and all that led to a column in *CQ*, and so on.

When single sideband came along I built a transmitter and helped pioneer that mode. I told you recently how I flew around the world in 1959 using one of the first transistorized sideband transceivers. I had to learn not only about sideband, but also about transistors. But I didn't do anything then that you can't do today. There are all kinds of opportunities open today for experimenters and pioneers.

When the FCC forced taxicabs to change to narrowband FM, that put thousands of old wideband rigs on the surplus market. This got amateur radio FM repeaters started in the 1960s. I was just about to put one on the air in 1965 from my shack high up on Mount Monadnock (NH). I had a technician working with a dealer, modifying a beaut of a rig for 440 MHz remote control. With the virtual collapse of amateur radio due to the ARRL's so-called Incentive Licensing deal, which almost put *73* out of business along with the rest of the industry, I didn't really get going strong until 1969, when I put my own repeater on Pack Monadnock.

I started a repeater magazine, published hundreds of articles in *73*, and put out a series of books. Suddenly repeaters and 2 meter FM became a big deal. The technology we hams developed was then put to work as cellular telephones.

My point is that no matter how complicated some new technology seems, it really doesn't take long for anyone to become an expert and be able to contribute experimentally.

I keep running into hams who've accepted my past challenges. There are some very wealthy hams today who got started with repeaters and went into cellular telephones. There are others who believed me when I recommended getting into security electronics. Hundreds of hams did very well when I touted them onto computers back in the beginning. I ran into one in Berlin last month.

All sorts of opportunities are still there as new technologies open.

In case you're worried about the competition from professional scientists and from well-funded laboratories, let me assure you that this is an exaggerated concern. Scientists tend to stick to what they know works and not venture into the unknown. And that goes even more for research funds, both at universities and from government sources.

Scientists are famous for ridiculing anything new. Famous scientists are well-known for rejecting legitimate discoveries. In case you've been brainwashed by pathological skeptics into doubting things such as faith healing, auras, spoon bending, clairvoyance, psychic phenomena, and so on, then you just haven't done much experimenting, or even much reading. Invest $4.95 for the pocketbook edition of Michael Crichton's *Travels* and come up to speed. It's a fun book. Mike's the chap who brought you *Jurassic Park*, and a bunch of other stories and movies . . . like *Rising Sun* and *The Andromeda Strain*.

The next thing you know I'll have you starting to read. Maybe even starting to think. I might get you excited about cold fusion. I met a chap at the cold fusion conference who's proven in his garage that it works. Now he may or may not make billions out of it but he has the chance, and you don't.

I met Bill Gates when he first got started with computers back in 1976. Ditto Steve Jobs, and most of the other wealthy computer pioneers. That was less than 20 years ago, at a time when I was urging my *73* readers to get involved with computers.

Now let's suppose that old Uncle Wayne gets under your skin and you decide to check out this cold fusion stuff. The next thing you know you are turning out more and more efficient ways of generating power. Then you get the bright idea to put a home experimenter's kit on the market in time for Christmas 1995 and you make a killing. You give 'em palladium mesh and nickel to use as cathodes and anodes: potassium and lithium salts for electrolytes; some deuterium, a thermocouple, a thermos bottle, and instructions. What parent wouldn't spend $79.95 for a kit like that?

Then you might start making miniature toy perpetual motion machines which generate enough power to light a halogen bulb, all just using water which is recycled.

Where does the power come from? Somehow it comes from the incredible power that holds our atoms together. No one knows yet for sure what's happening. Oh, we know that all matter is made up of energy, and we know we can unleash bunches of it with nuclear fission . . . and we're working on doing it with hot nuclear fusion. But apparently there are some ways of gently tapping into this unlimited power source without the usual humongous explosions.

There's lots more worth investigating. I've written about the need for more research into plant biology and communications, the power of ultraviolet light on all living things, bioelectromagnetism, and so on. Or, if you are hung up on radio, get busy inventing the next generation of digital radios.

Do you know what happens when you start a plant growing over the negative terminal of a magnet? The positive terminal? And how do these affect mice and rats? You won't believe it until you either read about it or do some of your own experiments. All it takes is a few beans and some patience to get started.

And when you've done that then I'll be after you to try some magnetized water and prayer, and see what happens then. Heh. We're just beginning to scratch the surface when it comes to science. Well, some of us are. The rest of us have been so immobilized by our lousy school system that we haven't any guts to do anything but make life miserable for ourselves and our families. Perhaps I'm exaggerating. A little. In some cases. RF

Why Should a Young Person Build?

The benefits may surprise you.

by James L. Griffith WA7NDD

Think of ham radio as a convention. Each of us enters this exciting hobby from a unique direction, like the entrance doors that surround a large convention hall. The door you use to enter the hobby represents your entire experience. That door is different from another ham's door, someone who may have entered the hobby for an entirely different reason.

Whatever the reason that piqued your interest in amateur radio, somehow you ended up at the same "convention" as the rest of us hams. We each have different experiences, abilities, education levels and jobs. Yet, we greet one another like long-lost friends with varying interests in amateur radio.

Many people with varied and uncommon interests exchanging ideas make ham radio one of the most exciting educational, learning-experience hobbies available to people of all ages. You gain experience and thus ability every time you make a contact on the radio.

My Door to a Ham License

As a teen-ager, I was fascinated by electricity. I was not sports-minded in high school and might have been considered a "nerd" by today's standards. My playing field was a small electronics workbench built for me by my father. My interest in electronics was supported by my parents and led me to an electronics building hobby that removed boredom from a restless mind. Building gave me years of enjoyment, a ham license, and special skills that led to a career.

My electronic building hobby helped me feel worth. It added self-confidence to a youth struggling for identity among his peers. If you're a teen-ager, a building hobby will do the same for you, even if you only build one small project a year.

The Way It Was

In 1960, exchanging ideas had absolutely nothing to do with my becoming a new ham operator. In the '50s and '60s, electronic magazines were a hotbed of construction articles. Electronics in general was touted as the career of the future; it still is. Not only did I want to be a part of the future, I found building electronic devices, however simple they might be, a positive and rewarding experience.

Surplus electronic parts were abundant. Although it seemed that no two parts were exactly alike, they did the job, and at minimum cost for a teen-age budget. You learned to adapt and modify. Duplicating exactly a piece of equipment in an article was not likely.

The rig design was always in modification until the final part was installed. Parts used in articles were taken from TVs or war surplus equipment. Many times, identical parts could not be found. If you were new to electronics, the frustration of parts procurement meant the end of the article before the soldering iron was even heated up.

There was not an electronic hobby magazine printed whose feature article for the month did not involve a building project. Later on, articles took a different slant: "Should You Buy or Build?" And today, more often than not, most of the articles are product reviews.

Building Is Better Today!

There is nothing wrong with product reviews. They reflect exciting change in electronic technology. We probably could not build a modern microprocessor-controlled rig at home. However, rigs can still be built. QRP mania is running rampant. Photo A, showing Bill KR8L's line of QRP home-brew and kit projects, is impressive. Bill KR8L started building as a teen-ager in 1961. Liner amplifiers, 12 volt power supplys for that modern rig, antenna tuners, and electronic keyers can save big bucks and are fun building projects.

"Buying tools is the best investment you can make."

There may not be as many constructions articles as there used to be but the projects that are written up are more buildable, duplicatable, and exciting to use. Ham builders save hundreds of dollars. Building a simple one- or two-chip RS-232 computer interface for one of the new radios that allow computer control will save $75.

Today, parts for articles are available on an "off-the-shelf" basis. Parts that before were difficult to find, such as inductors and coil forms for receivers and transmitters, are now furnished by specialized vendors selling toroid forms. For today's modern, simple-to-build circuits, inductors are no longer a problem. Transistors are more interchangeable than tubes ever were. This is a major benefit, saving time from parts scrounging, especially if you have other interests that take up hobby time.

Ham and other electronics magazines are full of vendors with standard, highly specialized parts at affordable prices. Frustration is avoided because articles can be duplicated down to the very part numbers. It is exciting that precision pieces of electronics can be built on the kitchen table. Many construction projects are as close as the nearest Radio Shack store. That's better than a month's wait from a catalog, as it was in the '60s.

Where Do You Start?

Buying tools is the best investment you can make. They are always worth what you pay for them, and they are a valuable asset that will save you money on car, household, and electronic repairs.

See Photo C. Basic tools are not expensive and will last a lifetime if cared for. A small soldering iron, a screwdriver kit with exchangeable blades and nut drivers, a pair of small side cutters, plus a needle nose and standard pliers, will take care of all but the most ambitious building projects, and will fit on the kitchen table.

If you are a young person, I'll bet Mom and Dad would rather invest in basic tools than in another Nintendo game. Surprise your parents. Give them a tool list for your birthday and for Christmas. Adding tools to your toolbox will become a passion and the tools will become proud possessions. Tools, and the skill developed in using them, are a valuable asset, not only to the work we do but to our quality of life. Using tools to build a piece of electronic hardware, no matter how simple or uninvolved it may be, will build confidence in abilities you never thought you had. Tools add a new range to your experience.

Continued on page 6

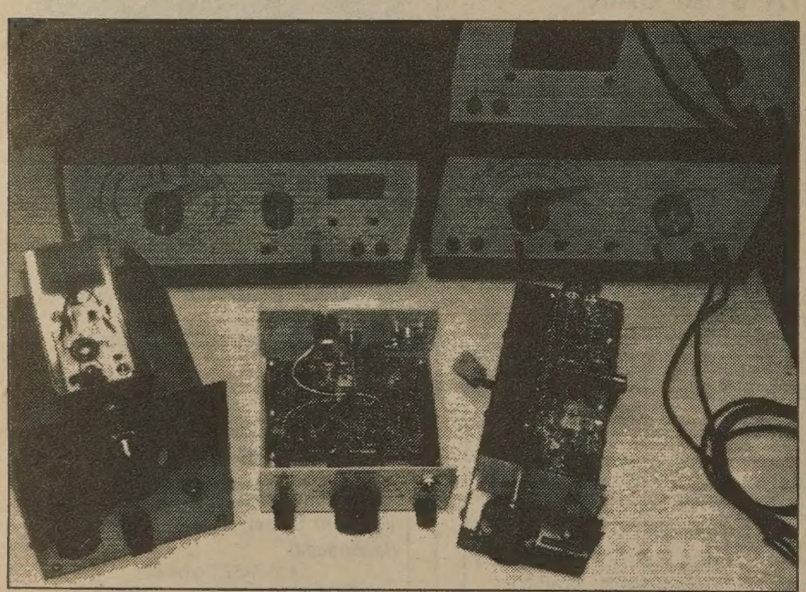

Photo A. KR8L's line of QRP projects demonstrate three construction techniques (right to left): 80 meter receiver from an ARRL publication, using home-brew circuit boards; Oak Hills' 40 meter QRP transceiver kit; and a 160 meter transmitter using a grid of copper pads made by cutting away the circuit board foil with a blade and lifting the foil off with the heat from a soldering iron.

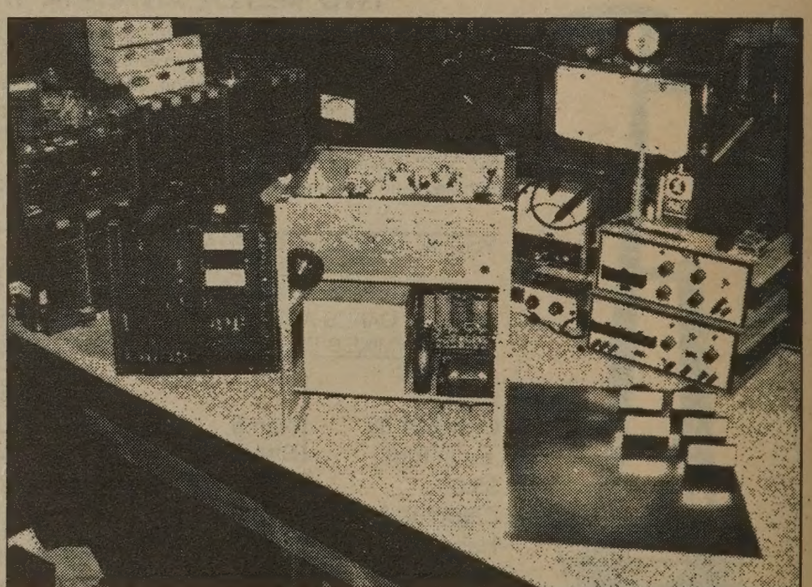

Photo B. The author's workbench. The box on the left is a 12 volt, 35 amp voltage- and current-regulated HF rig power supply built for about $6. Beside it is the current project, a 1kW HF amplifier running a pair of 4CX250Bs. The final cost is expected to be around $100. The amplifier front panel and meters are on the right. Notice the Heathkits in the background.

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letters

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D.E. George WP4XD, Isla Verde, PR My problem, and I'm sure other hams who have Heathkits have or will have this problem, is replacement of certain proprietary devices used in some kits. The immediate problem is with two ICs used in the Heath Handheld Frequency Counter Model IM2400. They are identified as Heath p/n 442-698 and p/n 443-937. I've searched my sources for these devices to no avail. HELP!

This poor meter (sad, not bad) went through Hurricane Hugo a few years ago, from which I lost the NiCds and now the High Frequency Channel. The Low Frequency Channel works fine, as did the High Frequency until last week. In the absence of the NiCads, I've been running off of a regulated power supply. Apparently, this power supply developed a spike(?) which popped these devices. I've temporarily replaced the p/n 442-698 with a MAR-1, but can't find a replacement for the divide-by-10 p/n 443-937 that can operate at 500 MHz! I would appreciate any help you could provide. Thanks in advance.

I have a Heath HW5400 that has some output devices: 417-971, 972-8973, that also fall into this category. Fortunately, the HW5400 survived Hugo totally unscathed!

P.S. I live about 100 feet from the ocean on the North Shore of Puerto Rico, so we got Hugo full force!

Dan—As it turns out, the Heath Company is still in business. They are no longer producing the catalog of products which made the name Heathkit legendary in ham radio circles. Yet, Heath's downsized descendant continues to provide some support for hams and others who need help.

As fate would have it, the two ICs you seek (Heath p/n 442-698 and p/n 443-937) are in stock and can be ordered direct from Heath Company, P.O. Box 1288, Benton Harbor MI 49023-1288; (616) 925-5899. While Heath Company may not be able to provide all of the technical support they used to back in the old days, they can sometimes refer you to other companies who can. Heath's general information number is (616) 925-6000.

—Charlie WA1RZW

Why Should a Young Person Build?

Continued from page 4

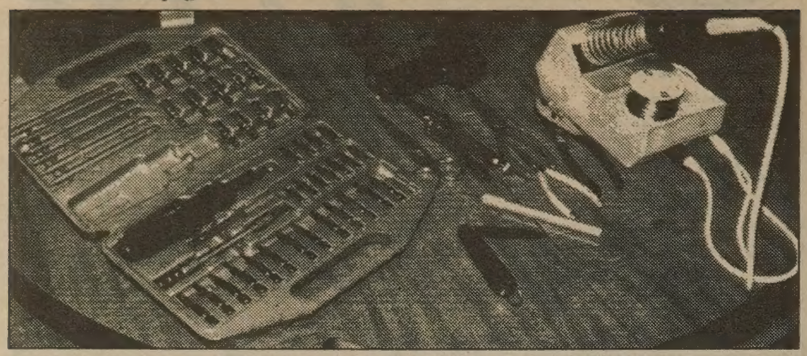


Photo C. You need simple but adequate tools for most building projects. I have found a pair of cable splicer's scissors to be a very handy tool. They'll cut circuit board and stay sharp.

Photo D. The author (then WA6JOS) in 1961, three years into a building hobby, standing next to a high school building project. This photo ran on the front page of the local newspaper and opened a door for him. This seemingly innocent building project led to his first job in the electronics industry.

So What Can You Build?

I took the simplest article project I could find, a one-tube receiver, and built it. It didn't work. It had great globs of solder flowing over anything solder could adhere to. I used a soldering iron with a tip bigger than the seven-pin tube socket I was trying to solder to. The point is, I started, and so should you.

Good, simple construction articles abound. You don't have to start with an article. Fix the phone jack on the end of your headphones. How about that mike connector? That's worthwhile construction. Small repairs are a good place to start. Some articles will pique your interest. They may seem difficult to build now, but with experience they will become second nature to build. Take that first building step with something within your skill range.

A useful project could be an external speaker for that HF rig with the scratchy-sounding two-inch speaker in it. Vendors want a lot of money for a box, a speaker, a pair of wires and a plug that mates to your rig. You'll find out how much fun it is building a small speaker cabinet to match your rig, using your own design.

Ingenuity is the adrenalin that feeds a project like this. One small idea leads to another. Soon, your speaker will look better than the factory model. It will sound as good and look like you wanted it to look.

Many times I've built something, used it, liked it, then had a more interesting idea, and ended up with three different models of the same thing. For instance, the external speaker worked well, but you don't have a lot of room on the desk in the corner where the rig and computer sit. The headphone jack in the radio is not convenient. So you add a headphone jack to the speaker box. You add a switch and jack to get the speaker audio to the RTTY terminal unit you purchased at a hamfest. You want just a little of the audio going to the terminal unit so you don't go diddle happy. So you add another switch and a couple of resistors that lower the volume, and that keeps the proper load on the audio output of your radio.

Over the space of a year, the external speaker had several face lifts, offered convenience, did the job and saved room. You would have never drilled into that $100 matching speaker. You did it all for only a few dollars, without a construction article. A local ham with 20 years of on-the-air experience helped you with the circuit for lowering the speaker volume, and now he's building an external speaker with two automotive digital clocks and a 12 volt power supply mounted in a slightly bigger speaker box. The $6 clocks had a 24-hour switch on them, so he set them for local time and UCT.

His speaker project turned out looking a little rough around the edges compared to your speaker project, but you'd never know by the confident smile on his face that, after all, it was his first building project. You ask him where he bought the digital clocks.

Organized Electronic Building

Many builders got their start with electronics kits, usually from Heath Company. Johnson and Hallicrafters also produced transmitter and receiver kits, but neither gained the popularity of Heathkit. Heath started thousands of hams on the road to building electronic equipment.

Kit building organizes and trains those unsure about their electronic building skills. Kit building is fun. The result for first-time builders will be a working piece of equipment that you can be proud of. Experience is gained and the kit will usually work the first time.

> ***"A building hobby can also bring awards, financial gain and career opportunities."***

Heath is still in business, but no longer produces electronic kits. Other kit producers are now filling the void. These companies seem more specialized in the equipment they offer than the broad spectrum of electronics that flooded the market from Heath. New companies are selling HF QRP rigs, keyers, amplifiers, transverters into the microwaves, and most antennas are kits that need mechanical assembly.

Kits are a good place to start. I recommend that someone new to electronic building try one, or several. Kit building will organize unsure building skills. You will carry that newborn confidence and skill to all projects you build.

Building at Your Fingertips

Eventually your eye will be trained. If you build and experiment you will see possibilities in surplus parts and equipment that others do not see. These parts can offer inexpensive additions to your ham shack that could cost a thousand dollars or more for vendor-manufactured equipment.

Have you noticed the sharp-eyed hams who are not too worried about being first to arrive at a hamfest? They bypass the low-priced rigs and equipment. They keep one eye on a special list of parts for ongoing projects while gazing at the tables with a knowing eye for electronic components.

Such a ham might not buy a component on his list. He might buy a part that sparks a new idea for another project. One thing is inevitable: He will always buy some parts.

For two years I have slowly collected parts to build an amplifier using a pair of 4CX250Bs (see Photo B), which I have a supply of. I scrounged everything. I bought parts at hamfests and did some trading. With all parts collected I have less then $75 involved in the amplifier, including the power supply. I feel like a super-sleuth when looking for components at the right price. For me, it is a fun part of the building hobby; it might also be for you. Patience in collecting parts is a virtue that will reward a ham with a piece of equipment that he could not afford for some time, if ever. Developing building skills will eventually bring you to the point of a keen eye and a ready buck for the right part.

Rewards and Activities

An electronic building hobby adds a great deal to life. Not only does it add enjoyment and satisfaction and help you put daily tensions aside for a while, a building hobby can also bring awards, financial gain and career opportunities.

I started my electronic building hobby in junior high school. By the time I was a senior in high school I had developed many skills. Nick Saba (now a Silent Key), my electronics teacher, gave me an opportunity to build a project and enter it in the "American Industrial Arts Association Contest." It won second place in the US and Canada.

Check with your school. There may be a rewarding building experience waiting for you that will add excitement to an already fascinating hobby. Photo D shows me standing next to the project. This photo, along with a short article, ran on the front page of the local morning newspaper. That article led directly to me getting my first job, building electronic equipment. If I had not embarked on a building hobby early on, Mr. Saba's project suggestion would have only been uneventful words in a teen-ager's life instead of a vision of how the project could be built and made to work.

Work on gaining building skill, keeping an eye out for opportunities to use the new skill. Check with your science and electronics teachers about science fairs and industry-sponsored events. Enter a hamfest home-brew contest. Ham radio club construction activities often produce a nice project, plus lots of fun and camaraderie.

If you are career-minded towards the electronics industry, building experience and a ham radio license may put you in the running for apprentice jobs. If you go to a four-year college or vocational college you'll find yourself a step ahead of the pack.

In the early '60s mentioning to an interviewer that you had a ham license could lead to the interviewer saying, "You're hired!" It happened to me several times and turned into a 33-year electronics career.

There will be some who will "ho-hum" electronics building in general. They may call you "cheap" for the way you buy, trade and scrounge parts. You will find parts scrounging skills valuable after a family comes along. When others might have to cut back on their hobbies, you will still be having fun.

This "wet blanket" attitude most likely comes from failures they've experienced. These folks will often point out the expense, that the project never works, that it takes too much time or is too hard, that your building skills aren't perfect, or even that the project isn't the best.

Don't listen to them! Avoid them. Hitch your soldering iron to helpful people. There are good builders willing to help a novice in the field of electronics and building. Find one of those people and pick his brain, accept his suggestions, linger in his compliments and store those building skills so that you in turn can pass them along. A lifetime of basic electronics self-reliance is waiting. All you have to do is start that first small building project. Your door to a bright future will swing wide open! RF

Staggering Figure

Cray Research of Eagan, Minnesota, says it discovered the largest known prime number during recent testing on a Cray C90 supercomputer. Researchers say the number has 258,716 digits, and is equal to 2 multiplied by itself 859,433 times, minus 1.

The discovery is what is called a Mersenne prime number, after Father Mersenne, a 17th-century French monk who searched religiously for such numbers. A prime number is a positive integer with no factor except itself and 1.

Cray says the largest prime number previously known was discovered in February 1992 at an English laboratory by scientists who were also working on a Cray supercomputer. That number had 227,832 digits. *TNX Electronic Engineering Times, January 17, 1994.*

College Bound

The Foundation for Amateur Radio, Inc., a non-profit organization headquartered in Washington, DC, plans to administer 49 scholarships for the 1994-95 academic year to assist radio amateurs. To qualify you must be a licensed ham and you must be enrolled in or accepted for enrollment in a full-time course of studies at an accredited university, college, or technical school.

The awards range from $500 to $2,000 with preference given, in some cases, to residents of certain geographical areas. Additional information and an application form can be requested by letter or QSL card, postmarked prior to April 30, 1994, from: *FAR Scholarships, 6903 Rhode Island Avenue, College Park, MD 20740.*

Cheap Chips

Less expensive integrated circuits are on the way because Sumitomo Chemical recently resumed production of epoxy resin. This special resin is necessary to produce memory chips. Experts believe this may lead to a quick end of the worldwide shortage of memory ICs.

Sumitomo Chemical has dominated worldwide production of epoxy resin. Production was interrupted last summer, however, with an explosion at the manufacturing plant. Another Japan-based chemical firm, Nippon Kayaku, says its new resin production facility will soon be constructed. It will produce resin for a 16-megabit DRAM chip. *TNX Westlink Report, No. 664, December 31, 1993.*

Phase 3-D Moving Forward

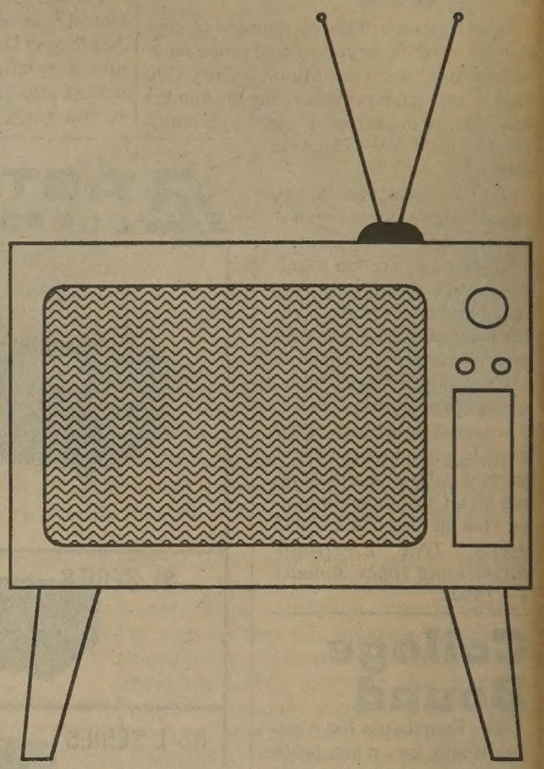
Following a series of meetings in both the United States and Germany, AMSAT's Phase 3-D Project Development Team has stepped up construction speed on amateur radio's newest satellite. Organizers say the project is "on track" for the launch of Phase 3-D slated for 1996.

According to Engineering V.P. Dick Jansson WD4FAB, "Each country's team is performing their assigned tasks very well." Dr. Tom Clark W3IWI, AMSAT North America's President Emeritus, added that the team is "... really pulling together as an international group. Thanks to the work of our European, South African, and Japanese friends, it now looks like we will have some superb cameras, some really 'hot' receivers, and some very powerful transmitters on Phase 3-D." Clark is now a key member of the team's Global Positioning System experiment group. *TNX Keith Baker KB1SF.*

Preventing Television Interference

How to keep TVI from spoiling the fun!

by Michael Bryce WB8VGE



After you've waited for what seems like a lifetime, your ticket finally turns up. You fire up the rig, take a deep breath and throw out your call for the first time. "CQ CQ CQ this is AA5 . . . ring, ring." "This is Doris next door. Whatever you're doing, it's coming through my TV." Welcome to the exciting world of TeleVision Interference, or TVI!

What is TVI?

Most often, TVI comes from one of two sources. The most common interference problems stem from harmonics generated by the transmitter. Harmonics that fall within the television broadcast channels will show up as interference on the screen or in the audio channel. Unless the interference is *very* strong, TVI usually disturbs only the video portion of the signal.

Depending on the amount of interference, the visible effects range from a series of light wiggle lines across the screen to a fully-blanked screen. Sometimes the screen will go "negative," turning the white parts of the screen black, and so on.

You'll sometimes see "sound bars" across the screen when operating SSB. Cross-hatching caused by the beat between the picture carrier and the interfering harmonic signal is the most popular cause of TVI. Depending on the strength of the harmonic signal, cross-hatching may range from minor to extreme.

The second type of TVI is caused by front-end overload. In this case, the television receiver is wiped out by the transmitter's fundamental frequency. Front-end overload generally cleans the TV's clock and the receiver goes belly up. Overall, front-end overload is hard to fix. You have to reduce your RF power and/or move your antenna away from the TV. Although not as common, there are even times when TVI can come in by way of the AC line.

Clean Your House First

Before you *say* you're clean, you'd better be sure you *are* clean. Can you transmit and not tear up your own TV? Can your spouse hear you over the toaster? Yes! Well, then you have a problem that needs correcting. The most effective method of reducing or eliminating TVI is to reduce or eliminate the harmonics coming from your transmitter.

You can reduce the harmonics generated in the transmitter, but it's not easy. This is normally a matter of circuit design. But, you can modify the way you're operating the gear. If you are running an older rig with a tube-type power amplifier (PA), you must be sure you have the tuning procedure down to a science. If you have the transmitter tuned incorrectly, you'll generate more harmonics and at greater levels than you should. A properly tuned tube final amplifier will actually reduce TVI due to the Pi-network in the transmitter.

With a solid-state transceiver, run the RF drive control up until you reach full power and then stop. Increasing the RF drive won't generate any more power to the antenna, but it will generate bucketfuls of TVI! Follow the instructions for your transceiver to the letter.

You also have to reduce any stray harmonics leaving the transmitter's case and wiring. This demands that the shielding and filtering of all circuits be in place. You're not running the rig with the top off, are you? If so, you're letting out stray harmonics that may be causing the trouble. The shields were put there for a reason: be sure you operate with them in place. If the transmitter is not emitting harmonics, then you've got a fighting chance of preventing harmonics from leaving through the antenna feedline by using a low-pass filter. We'll talk about these guys later. First, you have to reduce or prevent harmonics from being fed into the antenna system.

As a ham, you are required by law to operate a station with the cleanest signal purity. This is under part 97.73 of the U.S. amateur regulations.

TVI in the Ham Shack

Can you operate a TV in the same room as your rig? Transmit and watch the screen carefully. Notice any distortion on the screen? How does the audio sound? Any buzzes or clicks coming from the TV's speaker? If you have the TV connected to a cable system and you're clean, does your neighbor have cable, too? Can you operate the TV from an outside antenna system and still be TVI-clean in your shack? All these questions need to be addressed if you're going to have a fighting chance at slaying the TVI dragon. If you're clean in the shack, the next step is to find out what's going on with the neighbor's set.

Communication is the Key

You can unlock any problem if you just have the right key. Our key to unlocking the TVI problem is communication.

It's always best to keep the lines of communication open. If the door is shut, then nobody wins. In the worst case, if the TVI seems excessive, you may be put on quiet hours by the FCC, even if your station is clean. Quiet hours are those times you're allowed to operate your station, usually in the wee hours of the morning when everyone else is in bed.

Even if you're "right" and have a clean signal, you can be sued, taken to court, and generally have your life torn apart. Keep your cool and don't get mad.

So, the first step is to find out what kind of interference the neighbor is having. To do that, we need to ask a few simple and direct questions. Talk to your neighbor with an open mind. Don't put the blame on your neighbor's equipment. You'll find you'll hit a brick wall if you tell someone their $4,700 wide-screen TV is a piece of junk because it can't cope with the signal from your station. Nobody wants someone else to say the stuff they own is junk!

Most people know little about TVI, but they do know you're messing up their television. That's the only point they'll make, and it's up to you to fix the problem. Remember, they were happily watching "L.A. Law" until you started playing around with that ham radio stuff. Start by asking: *Did the interference start just now or have you had this problem before?* Ask questions to help put the puzzle together.

Remember, too, that RFI is a double-edged sword. The world is full of all kinds of electrical devices. We live in a world oozing EMI. A vacuum cleaner next door can easily wipe out 75 meters just as quickly as a ham can foul up a CNN newscast!

I'm a Ham, Not a CBer

Uninformed people tend to put ham operators and CBers into the same category. Everyone knows someone with a CB, but how many know a ham radio operator? For all we know, your upset neighbor has a friend whose TV got zapped by a CBer running illegal high power, and thus has concluded that *you* must be a CBer running high power.

Patiently tell your neighbor that you're a ham and not a CBer, and that you're willing and able to help solve the problem. How can

you help your neighbor distinguish between hams and CBers? It's not always easy, but I usually mention that I use Morse code and talk on the shortwave bands. You can also add that during the Gulf War hams provided a communications link between the troops and the folks back home.

Run Some Tests

You may need the service of another ham to key your rig while you look at the TV next door. Don't go next door with dirty shoes or oily workpants. Look professional. Try and present yourself as an expert in communications. If your neighbor won't let you in, so be it. If you're not invited in, don't press the matter. I've found most people will allow you to look at the TV while your buddy keys the transmitter to check for TVI.

If you can, check the antenna wires on the back of the set. Be sure they are good and tight. If the set is connected to the cable system, check the "F" connector to be sure it's tight.

Check the outside of the house for bad cable or antenna wires. If the neighbor is using an outside antenna, what does it look like? Are all the elements in place? Is the feedline connected or is it flopping around in the wind?

By the way, since you'll be transmitting a one-way message, pick a clear frequency and call "test TVI" de your call. Don't transmit without identifying your station. Also, try to find a clear frequency to do your testing on. Don't call TEST TVI on the Ohio Single Sideband Net, or any other nets for that matter.

If you have a hand-held 2 meter or other VHF/UHF radio, you can talk back and forth with your buddy at your shack from the neighbor's house. You can tell him to change bands, reduce power, and so on, without running back and forth between the two homes. This simple act will make the neighbor feel much better than if you were to tromp in and all of the house all day.

Try your transmitter on all bands and all modes. Try reducing the RF output power and observe the results. If you have different antennas, switch over and repeat the above test. You'll be surprised at what you see, or don't see, with a simple flip of a switch from one antenna to another.

If your transmitter is in fact producing TVI on the set, then the next step is to find the problem and establish the cure.

The Fix

If you have a "clean" shack then the TVI your neighbor is having is more than likely coming in via your antenna system. Check your antenna ground system! This is the first line of defense on TVI. Your entire shack MUST be grounded. This is both a defense against TVI and good common sense. Grounding will do little good however, if the TVI is being caused by VHF or UHF frequencies or harmonics in this range.

If your neighbor's set is connected to the cable system, have them call for an inspection. These are generally free-of-charge (but call first to make sure). In some cases, the ground connection between the drop line and the house may have an open connection. Also, have the cable technician check for the proper signal level on the drop line. If everything is up to snuff with the cable system, then it's time to break out some filters.

The Battle of the Filters

There are two main types of filters used to combat TVI: low-pass and high-pass. The low-pass filter belongs to the transmitter. Its job is to allow frequencies to pass to the antenna without attenuation below the cutoff frequency of the filter. Frequencies above the cutoff are greatly reduced. Most low-pass filters have a cutoff frequency of around 30 MHz. These filters usually provide attenuation of 35 dB or more above the cutoff frequency.

You can build your own low-pass filter, but I recommend that you save yourself the hassle and get one from a commercial source. These filters are available from such companies as Ten-Tec, MFJ, Drake and others. Low-pass filters come with power ratings. Get a KW power-rated filter even if you run QRP—then you'll never have to worry about cooking it. For the low-pass filter to work, you must have a proper station ground.

The use of a high-pass filter will improve the rejection of harmonics at the television receiver. A high-pass filter has a cutoff frequency just below the 54 MHz TV bands. The high-pass filter must be connected to the television's antenna input jack.

After you have paid out a pile of money on radio gear, don't be afraid to spend the extra $20 and get a good high-pass filter to keep peace in the neighborhood. It might be the best twenty bucks you'll ever spend.

Under NO condition should you ever connect a ground lead to a television! Do not make any changes to the receiver set. The only thing you should do is screw in the high-pass filter. Nothing more, nothing less. If your neighbor won't let you install the filter, so be it.

The TVI Dragon

The TVI dragon is a difficult beast to slay. You may have trouble with interference with telephones, intercoms, tape decks, and audio systems, or with the roughest one to fix, the VCR. Each one will require some sort of shielding and/or filters to clear up the problem.

The Dragon Wins

Sometimes, even with the best filters, the dragon wins! Now what do you do?

Use common sense when playing radio. If you're only buzzing the neighbor's TV, and their lights are out at 8 p.m., then play radio after 8!

Massillon, Ohio, where I live, has always been a football town. The Cleveland Browns have a strong following here. So, when the Browns are playing at home and the local station carrying the game is Channel 3, I don't operate 15 meters when I know my transmitter wipes out Channel 3. I operate on another band until the game is over, or I operate QRP.

Reduce your output power. This may be the simplest way to reduce your TVI. The lower the transmitter's power, the less chance you'll have of tearing up the local TVs. QRP is a lot of fun and I've never heard of one QRPer being put on quiet hours because of TVI.

Use coaxial feedlines to help reduce harmonic radiation. Open-wire feed is great, but it also increases the possibility of TVI. Sometimes a balun works wonders on stopping TVI by preventing energy from flowing up and down the feedline. The jury is still out on TVI and baluns. Give it a try and see what happens. If nothing else, they're great to connect the coax to.

Use frequency-resonant antennas. An antenna which resonates on only one frequency will not radiate harmonics as much as a multi-frequency antenna such as a trapped dipole.

Check your tune-up procedure. If you have a tuned stage which is out of tune then you may be generating more harmonics than you should be. Run the RF drive up only enough to provide the correct amount of output. Too much RF drive does very little for you, and often generates TVI!

Everyone Wins!

If you can fix the TVI problem, then you're happy and your neighbor is happy. In fact, you may have made a friend through ham radio. Your neighbor will tell friends how you fixed the problem free of charge.

Of course, this is only the tip of the iceberg. Reams of paper has been written on cures for TVI. Contact your local radio club. Many times ham radio clubs have set up special TVI committees to help solve those really tough problems. Contact the ARRL for their RFI (radio frequency interference) literature. Read all you can on the subject to get the best ideas from the mountain of information available.

TVI can be beaten. Sometimes the dragon is hard to kill, but it's always worth the effort. Go slowly, take your time, and experiment to find the dragon, and you too will be a TVI dragon slayer! RF

RF user's report

The Alinco DJ-180T 2 Meter HT

by Jim Hovanik N3KHM

Alinco Electronics Inc.
438 Amapola Avenue, Unit 130
Torrance CA 90501
Telephone: (310) 618-9017
Fax: (310) 618-8758
Price Class: $279

Several months ago my friend, whom I talked into getting licensed, purchased his first amateur radio. Having a limited budget, he decided on the Alinco DJ-180T, one of the lower-priced new radios on the market. I have had a good opportunity to work with this radio, and will attempt to relay my observations.

Since practically every radio tested these days meets or exceeds the published specifications, this article will deal with the features, conveniences and inconveniences encountered.

The Alinco DJ-180T is promoted as a back-to-basics and simple-to-operate radio. It comes out of the box with a 7.2 volt, 700 mAh battery, a belt clip, schematics, operating manual, and a wrist strap. The radio has an extended receive (RX) range of 130.000-173.995 MHz. The supplied battery provides for 2 watts of power. An optional 12 volt battery delivers power for 5 watts.

There are 10 memories. Channel number 0 is the call channel and can be brought up by pressing the call button.

Frequencies are entered into the VFO via the VFO tuning knob. There is no direct entering of frequencies. Holding the function button while rotating the VFO knob advances the frequency 1 MHz. When not holding the function button, the VFO knob advances the frequency one step at a time. The frequency steps are adjustable and can be set at 5, 10, 12.5, 15, 20, or 25 kHz.

> ***"The radio fits well in your hand, is rather compact, and feels solid."***

Entering a frequency into memory is a little tricky because the manual tells you to press a wrong button. You first go to the memory mode and select the desired memory channel. Then switch back to the VFO mode, dial up the desired frequency, set the repeater offset and CTCSS tone, and write it into memory. The repeater offsets are programmable and can be specified for each memory channel. The CTCSS tones can also be programmed for each channel, as well as whether to transmit and decode the tone.

The memory channels and the VFO can be scanned in either direction. When scanning, the radio locks onto an active channel for five seconds, then continues scanning. There is no lockout or skipping of memory channels when scanning.

There is a 16-key DTMF keypad. When transmitting DTMF tones, there is no audio feedback of the tones. The radio also features Hi or Low transmitting levels, selectable Automatic Power Off after 30 minutes of inactivity, and a monitor button. The monitor button does not open the squelch when in the CTCSS mode. Pressing any of the six function buttons produces an audio beep which can be turned off if desired.

The display shows the frequency, the repeater +/- offset, the memory channel number, a T and SQ for CTCSS operation, the transmit power level, AP for automatic power off, and BUSY when the frequency is in use. (I would like to have an LED indicating busy when in the CTCSS mode). There is no S/RF meter. A backlight on the display stays lit for five seconds after the initial press, and stays on for four seconds after the the last button press or VFO adjustment. The keypad and function buttons do not light.

The only problem encountered in six months of use was when the rig was accidentally reset. It is reset by holding the function key while powering the unit. After the reset, it would no longer receive out of band. It was found, by trial and error, that holding the lamp button during power up restored the extended RX. This was not mentioned in the manual.

The radio fits well in your hand, is rather compact, and feels solid. The keys are well spaced and the audio is very clear. The batteries and chargers are the same as those used by the Alinco DJ-580T. To use external power you must purchase an adapter that slides onto the bottom of the radio, displacing the battery.

The manual could have been better. As mentioned before, there was an incorrect step in the memory programming section, and it did not tell how to restore the extended RX after resetting the radio. The schematics show that the microphone jack is a stereo connection with a 5 volt supply on one of the contacts. Do not use a mono plug in the microphone jack.

The Alinco DJ-180T 2 meter HT.

As stated at the beginning, the DJ-180T was promoted as a basic radio with some advanced features. That explains why I have so many "There is no . . . "s in the review. The option I miss most is a channel lockout when scanning. Considering that Alinco offers a 50 and 200 channel memory unit, a channel lockout would be useful.

The DJ-180T is not the smallest or most full-featured radio on the market. However, it's not priced to be the best. It's priced to be affordable and reliable, and it is both of those things.

[Factory Postscript: Alinco has corrected the error in the operating instructions via an addendum at the back of the manual.] RF

High Performance Backpack 2 Meter Yagi

by Jim Adamson KD6LBW

How many advantages do you see from having a low-cost, high-performance 2 meter yagi that provides over 13 dB of gain, weighs under one pound, packs small enough to be carried in a backpack or briefcase and can be set up in two minutes?

I am Scoutmaster of Troop 780 in Placentia, California. We have several active ham Scouts so we have a need for such an antenna (see Photo A). I am always looking for ways to expand and improve our backpackable radio equipment, with particular emphasis on compact lightweight gear. Additional applications for this antenna would include T-hunts, remote Field Days, or emergency operations.

Antenna Design

The design calculations, listed in column 1 of Table 1, were derived from Bill Robertson W3HMI's article in the September 1992 issue of *73 Amateur Radio Today* and have been converted into inches. One of our Scouts, Rob Thompson KD6MDA, had great success in building Bill's project for use at our summer camp on Catalina Island. To make this six-foot-long, five-element yagi effective for backpack use, changes were needed. These included:

1. Reducing its weight;
2. Reducing its disassembled size; and
3. Giving it quick set-up capability.

These were the goals of this project.

After exploring several different materials and construction techniques, I determined that hollow aluminum arrow shafts would be the ideal choice. They are extremely lightweight, very rigid, have an anodized finish, and have inserts available which accept an 8-32 thread. The inserts are the key component in providing a strong and repeatable assembly. Photo B shows the arrow shaft, insert and threaded rod construction techniques I used.

After building several prototypes, the result was the Backpack Yagi design described in this article. It met my design goals by:

1. Weighing only 12 oz.;
2. Having a compact disassembled size with maximum section lengths of 20-3/4"; and
3. It assembles in two minutes or less without the use of tools.

Construction

Boom: The boom consists of four lengths of 3/8" diameter arrow shafts cut to 18-1/4" long. Inserts are pressed into adjoining sections and locked in place with a drop of cyanoacrylate glue (Super Glue). After the glue cures (about 10 minutes), the four boom sections are assembled together using three threaded 8-32 brass rods cut to 1" long. Tighten very firmly by hand. This is necessary to simulate final assembly to properly mark the boom and drill the holes for the elements.

To ensure proper element alignment, I marked a centerline lengthwise on the assembled boom and center-punched the element location per Table 1 and Figure 1. Carefully drill five 5/32" diameter holes at the marked locations perpendicular to the boom. I used a small bench drill press for this step. Five pieces of 8-32 threaded rods are cut 2" long and screwed into the drilled holes and centered about the boom. A drop of the glue will also lock these in place.

Elements: The 10 individual elements (two of each length) are cut from 1/4" diameter arrow shafts to the dimensions listed in Table 1 (arrow shaft length). I pressed and glued the threaded inserts into the open end before measuring and cutting to include the portion of the insert that extends beyond the shaft. Note that the individual element lengths are calculated from the formula in Table 1 by using the desired center frequency to determine the total element length, less the boom outside diameter, and dividing the result by two.

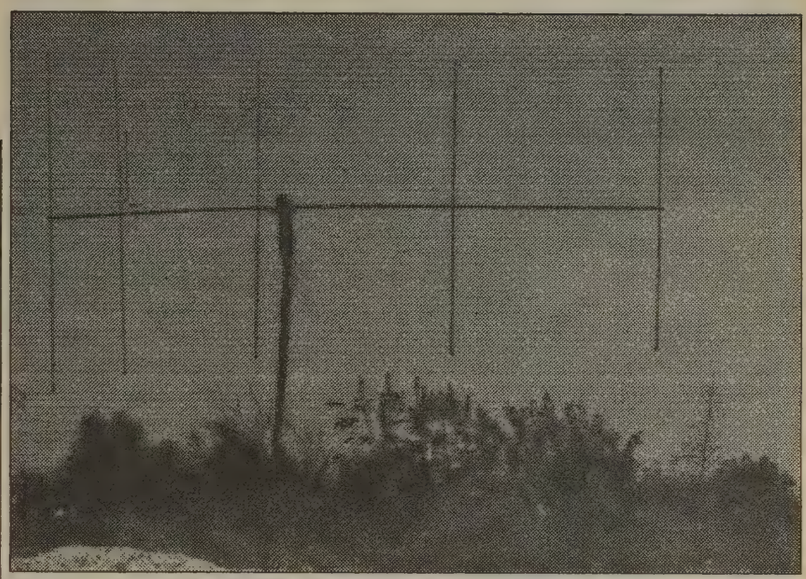


Photo A. Assembled 12 oz. Backpack Yagi.

I added plastic-tipped caps on the cut element ends for a finished look. You can now easily thread the elements on or off the boom (see Photo C).

Match: I made the match from a 10-1/2" piece of RG-8 coax with the jacket and braided shield removed. It is inserted into a 9-1/2" length of 3/8" diameter arrow shaft. The dielectric is stripped back 1/2" and the center conductor is soldered to a BNC female chassis-mount connector attached to an "L" bracket made from a 1/2" x 1-1/2" piece of scrap aluminum (See Photo D). I chose the BNC over the SO-239 for its smaller size and lighter weight, plus it allows the use of a BNC male-to-male cable for the feedline to my HT. Heat-shrink tubing over the solder joint stiffens the assembly. A 10-32 nut is epoxied to the bottom of the bracket, allowing attachment to the boom with a 1/2" long 10-32 thumb screw. Drill the hole in the boom for this screw when the match assembly is complete and the proper hole location can be determined.

The match is attached to one of the two radiating elements with two pairs of plastic cable clamps joined in the center with 3/8" x 6-32 nuts and bolts. The adjustable part of the match is made from a 1/2" x 3" piece of scrap aluminum formed around the radiating element and the match, then joined in the center with a 3/8" x 6-32 nut and bolt.

Final Assembly and Tuning

Do not drill through the boom to attach a mast-mount U-bolt. Drilling 1/4" diameter holes in the 3/8" diameter boom will weaken it and cause it to fracture. To solve this, I drilled holes for the U-bolt in a 1" x 3" metal plate and attached it to the boom with two plastic cable clamps using 3/8" x 6-32 nuts and bolts (see Photo E). I also replaced the hex nuts on the U-bolt with wing nuts for "no-tool" field assembly.

A nonmetallic mast should be used to prevent detuning when using the antenna in a vertical polarization mode. I use my hiking staff for the mast when in the field. A piece of PVC or wood dowel also works very well.

It took about 20 minutes to tune the antenna by moving the aluminum strap on the match, as well as adjusting the insertion length of the RG-8 in the tube for minimum VSWR. A very impressive 1.15 maximum VSWR over 144-147 MHz was achieved. Hot glue was then used to secure the RG-8 at the set location in the tube.

The disassembled Backpack Yagi is stored in a 3" x 24" nylon tent pole bag.

Finding Supplies

Most sporting goods stores carry a selection of complete aluminum arrow assemblies with the feathers, notch, and insert attached. These could be used but are more costly than shafts and inserts alone. I obtained my aluminum shafts from Arrow Manufacturing in Costa Mesa, California (714) 545-6102. They carry a very large selection of shafts of various diameters and wall thicknesses, along with the necessary threaded inserts. I used

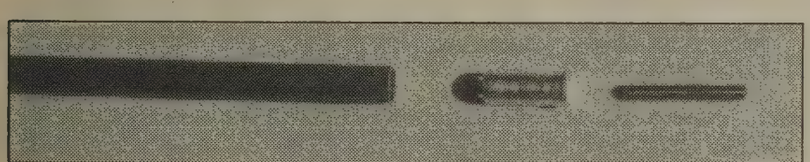


Photo B. Construction technique using aluminum arrow shaft, threaded insert and threaded brass rod.

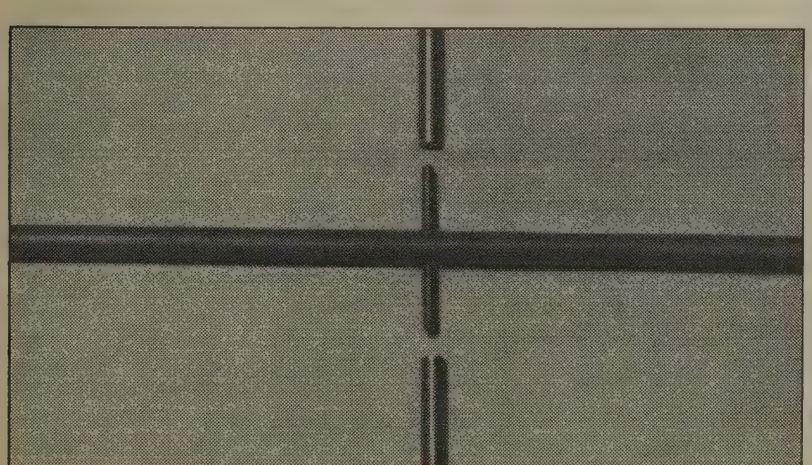


Photo C. Elements thread onto the boom.

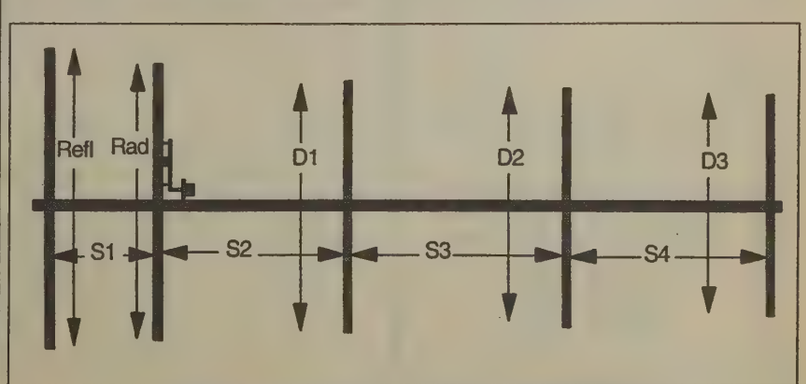


Figure 1. Backpack Yagi element configuration.

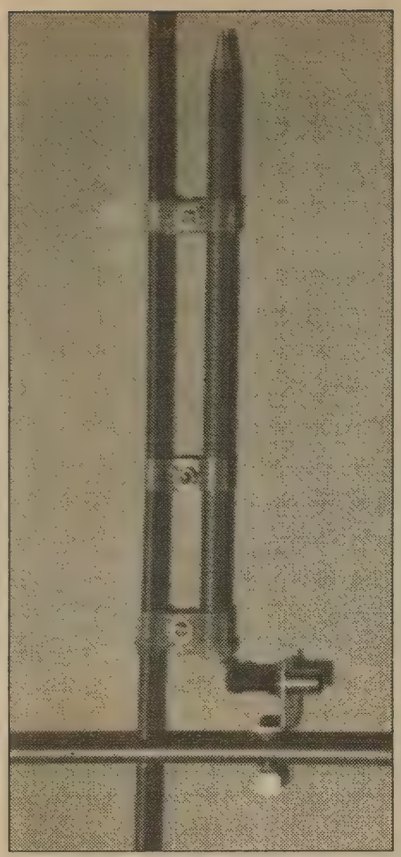


Photo D. Match detail using RG-8 and a length of arrow shaft.

their #2419 for the 3/8" diameter and #1716 for the 1/4" diameter shafts. The RG-8 coax and cable clamps were obtained from the local electronics store, while the remaining nuts, bolts, and brackets came from the hardware store and my junk box.

Conclusion

The Backpack Yagi works extremely well and has met all of my backpack requirements. The arrow shaft construction techniques I used builds quickly and results in a professional-looking project. It can be adapted to other frequencies of this yagi design or to an unlimited number of other antenna designs. Let your imagination be your guide RF

Parts List

4 ea.	3/8" diameter #2419 arrow shafts
10 ea.	1/4" diameter #1716 arrow shafts
6 ea.	3/8" shaft inserts
10 ea.	1/4" shaft inserts
13"	8-32 threaded brass rod
10	Plastic tip caps
6	Plastic cable clamps
10-1/2"	RG-8 coax
1	BNC female chassis connector
Various	Misc. scrap aluminum, nuts and bolts

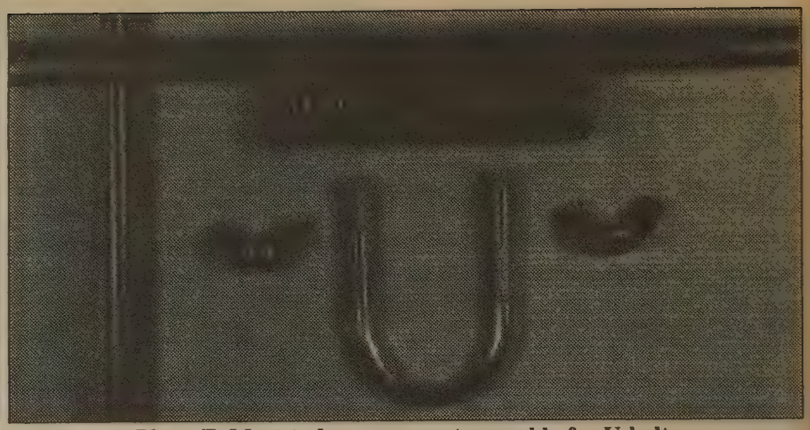


Photo E. Mast-to-boom support assembly for U-bolt.

Table 1. Backpack Yagi Dimensions

Formulas for Yagi Design		Element & Space Dimensions @ 146 MHz	Arrow Shaft Lengths @ 146 MHz
Reflector	6108/f	41.84	20.73
Space 1	1272/f	8.71	
Radiator	5592/f	38.30	18.96
Space 2	2448/f	16.77	
Director 1	5232/f	35.84	17.73
Space 3	3360/f	23.01	
Director 2	5076/f	34.77	17.20
Space 4	3468/f	23.75	
Director 3	4800/f	32.88	16.25

Frequency (f) in MHz
Lengths in inches.
Arrow shaft length = (total element length - boom diameter)/2

Un-Boring CW

Morse code tips for new hams.

by Ted Hermann AE8G

Many new Technician Class operators have recently upgraded to Tech Plus. New Novices are also hitting the CW bands. Let's face it: At slow speeds, CW can be boring (at high speeds it's exciting.) Here are 10 suggestions to make CW more satisfying.

1. **Throw away your straight key.** (Not really! Assign a place for it in the bottom of your junk box.) I can't think of anything that turns off potential CW operators as quickly as a straight key. Marconi and spark gap transmitters and straight keys are relics and should be retired. Avoid dinosaurs (WWII vintage semi-automatic keys) if you can, for the same reason.

You have two alternatives for new equipment. The cheapest alternative is to buy a keyboard. MFJ makes a dedicated keyboard for only $89. The more expensive alternative is to buy a new electronic keyer.

Once you use a keyboard, you will never go back to an electronic keyer. Keyboards never send "6" for "b." Hunt-and-peck typists can easily send perfect CW at 20 wpm or more. You can even erase your errors before they are sent out!

2. **Learn the other station's callsign** at the beginning of a contact. After that, NEVER send the other station's callsign except optionally at the very end of your very last transmission.

In place of the old-fashioned "hiscallsign de mycallsign," send BK, once, as your very first and last characters on each transmission. Needless callsign exchanges are boring.

The FCC requires us to ID every 10 minutes. To properly observe the 10-minute rule, send only YOUR callsign once every fifth transmission or so.

Chances are, the other station will be doing it the boring way. Often, the other station will notice your superior technique and change his style to yours—right in the middle of the QSO.

3. **Do not send "R R R"** and then proceed to verify everything you just heard. It's boring. You don't have to prove you copied it! If you did not copy everything, send "BK OK Tom," or "BK OK on most," or "BK missed some." Ask for a repeat only if you really want the information.

4. **Avoid abbreviations** except for the most common ones. Don't send: "am gg to lcl hamfest tmrw—luking fer 250 hz narrow fltr fer rig." Rather, send: "Going to hamfest tomorrow—need CW filter fer rig."

5. **Avoid placing abbreviations adjacent to one another.** Don't send: "vy fb rig u hv thr om hr usng ft nnt w inv v at 30 ft." The other operator could have missed a letter or two and thus be unable to copy the whole thing. It would have been better to send: "Nice rig you hv there—rig hr is FT-990 with inv vee ant up 30 ft."

6. **Never send your address unless you are requested to.** Of course, it's OK for you to ask for one. It's boring to copy someone's address when you don't want to know it.

7. **Make your dashes SEEM 10 times longer than a dot** when using a straight key or bug. New hams tend to make their dashes far too short when using these antiques. Ask the other operator if your dashes are long enough. Also, with antiques, put plenty of silent space between words. If the other stations always seem to get called for dinner or have a land line and must QRT, maybe it's really just difficult to copy your fist!

8. **Listen to 40 meter CW in the mornings**—the earlier the better! 40 meter CW at night is murder due to the international broadcasting. You will hear CW anywhere from 7.000 through 7.150 MHz. Don't let your pride prevent you from sending QRS ("send slower"). Every fast CW operator I know agrees that we need more CW operators. To encourage you to become one, they will all QRS.

When veteran CW operators slow down, they sometimes move up to the 40 meter Novice band. Many do this because they cannot SEND fast. They can still RECEIVE fast but their hand and finger control wanes. So, they move up to the Novice bands where everyone expects to hear slow CW. They are often retired and operate seven days a week. The techniques you will hear them use are pure gold for you. Observe and imitate their styles.

9. **The next best place to hear good CW is 30 meters** (10.0 MHz). This a a CW-only band and there are no Novice privileges there. Many 40 and 80 meter CW operators move up there to avoid summertime QRN. Listen in for 24-hour-a-day code practice.

10. **The 80 meter band is almost useless during the summer** due to QRN. There is a slow-speed CW traffic net (QFNS) on 3.715 MHz at 8 p.m. daily.

15 meter CW is heavily populated with DX-chasers. They often don't want to rag-chew. If the QRN on 40 meters is too loud, then 80 is worse and this is the only real alternative for Novices.

10 meters is nearly dead, and will get worse for the next several years. Five years from now it will only be as good as it is today! Of course, 10 meter ground-wave propagation will always support local communication.

20 meters is also heavily populated with DX chasers, but you can listen to QSOs at all speeds there. Too bad it's not a Novice band.

I hope these 10 suggestions will encourage you to give CW a try. It doesn't have to be boring. I absolutely guarantee that a half hour of CW when you get home from work will seal off the frustrations of the work day and make the rest of your day more enjoyable. 73 es GL de Ted Hermann AE8G. *Reprinted from* The Propagator—*West Palm Beach Amateur Radio Club, Inc.* RF

the tech side

by Michael Jay Geier KB1UM

Armstrong's Magnificent Invention

As a ham, your life has been greatly influenced by Armstrong. No, not Louis. Not even Neil, although I suppose he did make the ultimate EME (earth-moon-earth) trip—talk about moonbounce!

No, I'm talking about Edwin Armstrong, the amazing man who invented the regenerative receiver, FM and this month's topic, the superheterodyne receiver, which is used for just about all radio and television communications in the world today. Specifically, we are going to take a look at the IF (intermediate frequency) concept at the heart of the superhet. What is it, and what does it do for us?

Once Upon A Time . . .

In the early days of radio, sensitivity and selectivity were hard to come by. A crystal set, with its single tuned circuit, had no gain. So, you needed fairly strong signals from the transmitter or you just couldn't hear them. But that single tuned circuit also limited the receiver's selectivity; it was hard to separate stations which were close to each other in frequency.

When the Audion amplifying tube was invented by Deforrest, it quickly swept the crystal set into oblivion. Now you could take small signals and make them much bigger. Hey, maybe this radio thing was practical after all! But, the tube didn't help the selectivity problem at all. In fact, it made it worse, because your dial was now filled with interference from more distant stations you couldn't hear before.

More Is Better

It seemed obvious that, if one tuned circuit gave you some selectivity, more of them would give you more selectivity. And, indeed, that was the case. The TRF, or "tuned radio frequency" design, was very popular for a while. It worked reasonably well, but it had some serious drawbacks. First of all, it required all the stages to be tuned to the same frequency, and that frequency had to match the one of the station you were trying to receive. So, you had a knob for each stage, and you had to turn them all and peak them carefully every time you changed stations. You can imagine how well that went over with the folks whose grandkids ultimately wouldn't be able to set the clocks on their VCRs! The simple solution was to gang all the variable capacitors together into one knob, and some sets were made that way. Unfortunately, it was hard to make all the stages track each other across the dial, so that approach was something of a performance compromise. Also, it required a belt or a chain, which was pushing things mechanically in those days, especially if you wanted to make the radios affordable.

There was another, perhaps more serious, problem with the TRF: Because the amplifiers were all on the same frequency as the incoming signal, the potential for self-blockage and uncontrollable feedback was high. After all, big signals on the input frequency which are generated right in the radio are going to be stronger and harder to contain than those coming from a transmitter miles away!

Edwin to the Rescue

Armstrong found an answer to the TRF problems and simultaneously solved the selectivity problem once and for all time, but it wasn't easy to make it work in a real radio. The basic reasoning was this: If it's so hard to make a series of tuned stages move from frequency to frequency, and you also don't want them to be on the same frequency you're trying to receive, why not put them on another, fixed frequency and set whatever signal you're attempting to listen to on your radio's fixed frequency? That must have been a stunning revelation, and it seemed to offer a solution to nearly all receiver problems. But how do you actually do something like that?

Well, making the tuned stages wasn't hard; they were pretty much the same as the TRF stages already in common use. This time, though, big variable capacitors weren't needed, since the frequency would never be retuned. In fact, fixed capacitors could be used along with slug-tuned coils, with the metal tuning slugs being set once and forgotten. That handy scheme continues to be used in most receivers today.

OK, we've got the easy part nailed. But how do we take a station on some arbitrary frequency which will change as we tune around the band and make it appear on our tuned stages' frequency, no matter where we turn the dial? When Armstrong conceived the idea, the notion of a mixer didn't exist.

Mix to the Max

Armstrong understood that, if he mixed the incoming signals with a locally generated one (made by what is still called the "local oscillator"), he could create a new signal at any frequency he wanted, and its modulation would follow that of the two original signals combined. So, if the local oscillator had no modulation at all, the new signal would simply be a frequency-shifted copy of the original one. Does this really work?

A Fine Mess

Well, yes, but there's a hitch. The signals can't just be "mixed" in a resistor; simply combining them won't produce a new signal. To see why, think of your stereo. You can have two musical notes at the same time, and their waveforms obviously must be combined into some composite wave, yet they don't form a new, false note, do they? But what happens if you turn up the volume so loud that the audio amplifier starts to clip off the tops and bottoms of the waveform because it just can't give any more? OK, you go deaf. But also, now the two notes will interfere with each other because, at the moment one of them exceeds the amplifier's capabilities, it blocks the *other* one from being properly amplified, too. The result is ugly distortion which includes some new notes, notably (ouch, pun intended) at pitches which are the sum and difference of the two original notes. If one is, say, 440 Hz and the other is 500 Hz, you'll get the two originals plus 990 Hz and 60 Hz. Yuck, what a mess. But, this particular mess is very useful at radio frequencies, and a mixer really is nothing more than a non-linear stage, much like the overdriven stereo amp.

Using It

Let's say you make all your tuned circuits operate at 455 kHz, which happens to be a common value in actual use. If you want to move a 1.2 MHz (1200 kHz) signal from the middle of the AM band down to this frequency, you need to mix it with a local signal of 745 kHz. You could also use one at 1655 kHz; it doesn't matter whether the local signal is above or below the incoming signal. But for clarity's sake, let's assume the local is below. That arrangement will also give you an output signal at 1945 kHz, but you can easily reject that one because it's nowhere near the one you want, and your tuned circuits won't pass it.

When TRF stages are used this way, we call them IF, or "intermediate frequency," stages. IF amplifiers are the backbones of just about all modern receivers. In addition to using normal coil-capacitor tuned circuits, you also can use such highly selective but fixed-frequency filters as crystals and ceramics, because you no longer have a requirement that your tuned circuits follow the frequencies of the signals you tune in as you turn the dial. With such filters, you can achieve selectivity far greater than anything you can get with the simple tuned circuits available for variable-frequency operation.

Follow Me

Converting the varying frequencies to one fixed one was a stroke of brilliance, but how could you make the local oscillator track your tuning as you turned the dial? The answer wasn't really hard. All it took was a tuning capacitor with two sections, one for the antenna tuned circuit and one for the local oscillator. The oscillator's frequency would determine the signal you received, while the antenna tuned circuit would simply peak the signal for best sensitivity. If they didn't track exactly, your radio might not be quite as sensitive at the band edges as it was in the middle of the band, but so what? It still was tremendously better than anything that had come before it. Armstrong called this scheme the "superheterodyne," which means "to mix above," the "above" referring to the fact that the resulting mixing products were still above the audio range.

An Image Problem

Yup, the superhet seemed to solve all of radio's problems. Now you had selectivity and sensitivity at the same time. But wait, there were a few new problems created, too. Specifically, early superhet receivers tended to pick up more than one station at a time! Hang on, didn't I just say the selectivity problem was solved? It was—these signals weren't next to each other. The trouble came from a basic characteristic of the mixing process: You got both the sum and difference frequencies. Let's take the previous example and run a few numbers. If you mixed the incoming 1.2 MHz signal with a 745 kHz oscillator to get your 455 kHz, that worked fine. But, if there happened to be another signal at 290 kHz, that one would subtract from the 745 kHz and *also* produce a 455 kHz signal; to the succeeding IF stages, they'd appear exactly the same! Obviously, the antenna tuned circuit would keep such widely differing input signals out, so it wasn't a problem at such low frequencies.

Going Up

But, as higher frequencies began being explored, these unwanted signals, called "images," really got to be troublesome. If you're receiving, say, 20 MHz with a receiver whose IF is 455 kHz, then your local oscillator is running at 19.545 or 20.455 MHz. For example, let's say the oscillator is at 19.545 MHz. Now, a signal at 19.09 MHz will also produce a 455 kHz output from the mixer, and those two input frequencies are pretty darned close together, when you consider their difference as a total percentage of their frequencies. Heck, if the antenna tuned circuits were all *that* selective, we never would've needed the superhet in the first place!

Repeat After Me

There's a way out, and most modern receivers employ it. The answer to this problem is to use a high IF frequency, which ensures that the image frequencies will be far enough apart that the antenna tuned circuit can select only the one you want. But, that means the selectivity of your IF stages won't be that great because, just as with the antenna tuned circuit, the total selectivity is related to a percentage of the operating frequency; you can't get as narrow a tuned circuit at 20 MHz as you can at 100 kHz. So, many of today's radios convert the frequencies *twice* or more. The first IF is set to a high frequency for image rejection, and the subsequent ones are set to low frequencies for selectivity. It's not hard to do, because only the first local oscillator needs to be tunable; the others can all be fixed, because the output of the first IF never moves, regardless of where you turn the dial. Problem solved, once and for all.

And Edwin?

You may be wondering what Edwin Armstrong got for all his brilliance and toil. When the staggering value of his radio patents became apparent, he was sued by a large corporation in an attempt to break his hold on the technology. He was kept in court for years, until he was financially wiped out, and he ended it all by jumping out a window. Had he not been so mistreated, he likely would have wound up a billionaire.

On that happy note, I'll leave you all to ponder the cleverness of your receivers until next month. 73 from KB1UM. RF

radio magic

by Michael Bryce WB8VGE

Oscillators

RF oscillators are the fundamental building blocks of radio. Without them, we would still be using spark. Even the fancy import super rig you're using is full of oscillators. From the master clock oscillator to the switching power supply, it's full of oscillators. This month, I'll show you how to tell one oscillator from another and offer some tips on how they operate.

There is an old saying about oscillators: "Oscillators don't and amplifiers do." There is very little difference between an oscillator and an amplifier. In fact, an oscillator is actually a special type of amplifier. In the simplest case, an active device, perhaps a tube, transistor, or even an FET, amplifies the signal applied to its input. A small amount of the output is fed back into the input. Once this process starts, the output feeds back into the input, which goes to the output which feeds back into the input . . . Whoa! We have an oscillator! It really is that simple. Until you try to build one, that is.

What we have is a feedback loop. In fact, it's called a positive feedback loop. Have you ever tried to make a tape recording and put the microphone too close to the speaker? All that howling and squealing is caused by positive feedback. If the feedback is too light, the oscillator may not operate smoothly. If the feedback is too heavy, the oscillator will not operate at all. You can't pull too much energy from the oscillator. Doing so will "load the oscillator down," causing it to stop. Most oscillators have a high impedance output. Sometimes several stages of buffers and amplifiers are used to get the output of an oscillator up to usable levels.

The reason why the saying goes "oscillator don't and amplifier do" is simple. If an oscillator is supposed to oscillate, it won't if there is some sliver of trouble in the circuit. On the other hand, amplifiers, especially high-gain amplifiers, will take off and start to oscillate all by themselves. All you need is a fraction of the output to be seen by the input and whoa, your amplifier has become an oscillator.

Oscillator Types

There are many different types of oscillators. An oscillator can use many different active devices: bipolar transistors, FETs, ICs, and even tubes. But, no matter what you use, there are some basic oscillator types. I'll discuss three of the most popular: the Pierce, the Colpitts, and the Hartley.

The Pierce Oscillator

You see this guy all the time. It's very common and is used everywhere from clock circuits in frequency counters to QRP transmitters. Take a look at Figure 1, the Pierce oscillator using an FET as the active device. In the Pierce oscillator, the crystal controls the frequency of the oscillator. The capacitor between the output on the drain lead couples energy from the output to the crystal. This capacitor supplies the necessary feedback to get the oscillator running. You can tell the Pierce oscillator from others because it has the crystal.

Because there are harmonics generated in this type of oscillator, some means of filtering the harmonics out may be needed if you're planning on using this circuit in an RF design. The filtering can be done in the next stage, while the level of harmonics is at its lowest. It is very common to use a bandpass filter or other tuned stage following the oscillator.

You can use these same harmonics to your advantage, too. For example, you need a stable output frequency but at a rather high frequency. By using some tuned circuits with very high Q and a crystal cut for overtone use, any harmonic can be pulled out of the circuit and used. Common harmonics are the third and fifth harmonics of the crystal. The crystal oscillates near an odd multiple of the fundamental cut in this case.

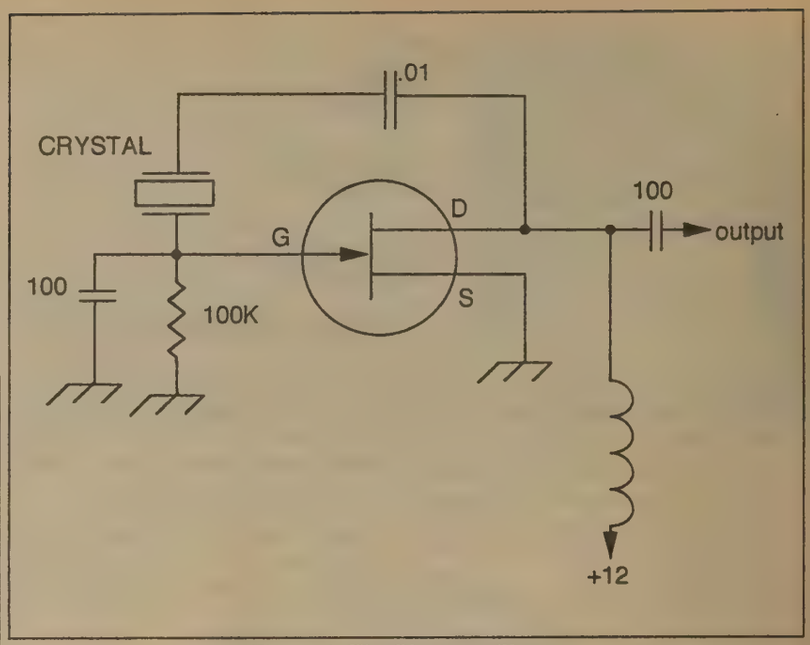


Figure 1. The Pierce oscillator.

Although the frequency is controlled by the crystal, and unless you want to change crystals, moving the frequency of the Pierce oscillator is hard to do. Not impossible, but hard to do. If you only want to move the crystal's frequency just a tiny bit, we can do that with ease. In the case of the Pierce oscillator, we need to add a variable capacitor in series with the crystal. By varying the amount of capacitance, we can move the frequency of the crystal a bit. Depending on the crystal, we can get several kHz worth of movement. This type of circuit is known as a variable-crystal oscillator, or VXO.

The Colpitts Oscillator

This oscillator does away with the crystal. In its place, a coil or inductor is used in combination with a variable capacitor. This type of oscillator will generally be found in VFOs or other circuits in which you need to change the frequency of the oscillator. Notice the two capacitors between the gate of the FET and ground. These capacitors make identifying the Colpitts oscillator easy. The capacitors are split in two and tapped in the middle. So, a Colpitts oscillator has two capacitors tapped in the middle. Because of the inductor and capacitors used in the Colpitts oscillator, the maximum usable frequency is about 10 MHz. You can get to 14 MHz, but instability will more than likely cause you more trouble than you want.

The Hartley Oscillator

This is the third type oscillator. In the Hartley, you'll notice there are no split capacitors as there are in the Colpitts; instead, it has a coil with a tap. This tapped coil is an instant giveaway of the Hartley oscillator. The frequency is adjusted by changing the inductance of the coil. The Hartley oscillator is also used in VFO circuits. In the permeability-tuned oscillator, there is a movable iron slug used to change the inductance of the coil. This gives us a change in frequency. By changing the pitch of the wire wound on the form holding the coil, we can achieve a very linear tuning range. This is normally not

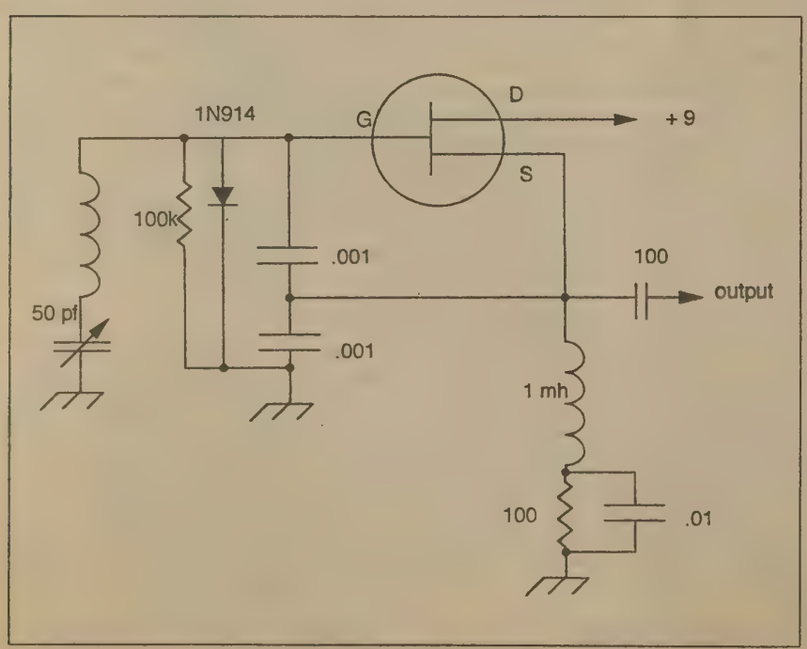


Figure 2. The Colpitts oscillator.

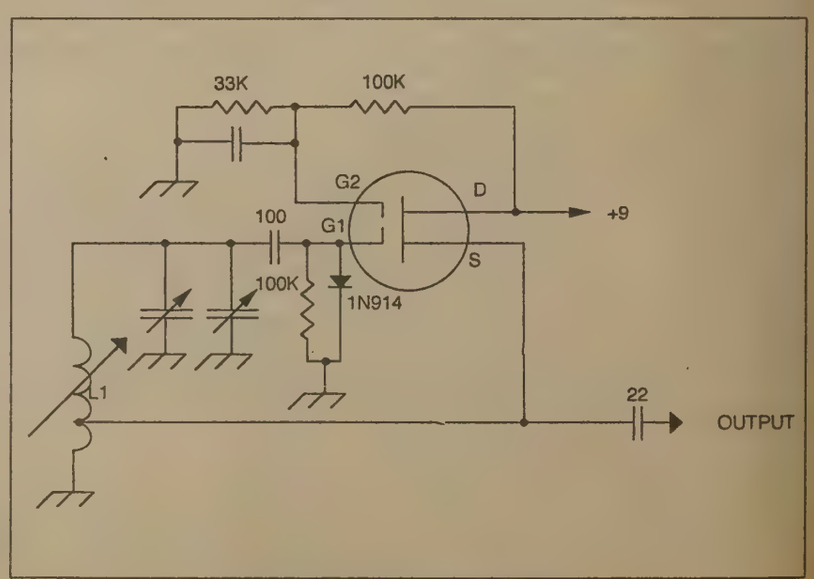


Figure 3. The Hartley oscillator.

possible when the Colpitts oscillator is used. Again, because of instability, the Hartley oscillator is not used above 10 MHz.

In the case of the Colpitts and the Hartley, high frequency operation is their downfall. But, you can use a method called heterodyne mixing. Here, you operate your Colpitts oscillator at a frequency the oscillator likes. In most VFO circuits, the frequency of choice is 5 to 5.5 MHz. You then mix the VFO with the output of a Pierce oscillator set to 12.5 MHz. The two frequencies combine and the result is 17.3 MHz to 17.6 MHz. A bandpass filter gets rid of the 5 and the 12.3 MHz frequencies. The result may then be used by the next stage, usually a mixer and on you go to the rest of the circuitry. In the case above, the IF of the receiver would be 3.3 MHz. With the IF at 3.3 MHz, the result would be 14 MHz (17.3 MHz minus 3.3 MHz equals 14 MHz).

Mix and Match

It's possible to add several features of one oscillator to that of another oscillator. In fact, you'll see this a lot in today's circuits. A popular circuit is the mixing of the Pierce crystal oscillator with the Colpitts oscillator. This mating of circuits adds stability to the Colpitts oscillator while keeping down the part count. It's also cheaper to build, since you don't have to install the inductor and its capacitors. These two items must be of high quality or the oscillator will be unusable in your application.

Loose Ends

In all the examples of oscillators, there is one missing and very important ingredient: the need for a stable operating voltage. If the operating voltage is able to move around, so will your oscillator. A well-regulated supply voltage is necessary for a stable oscillator.

Sometimes, the oscillator will produce VHF and UHF parasitic oscillations. These critters are hard to find, but are usually easy to get rid of. Usually a small value resistor in the collector or some ferrite beads applied to the base will take care of any parasitics you may have.

When working with a Colpitts or Hartley oscillator, especially in circuits for VFOs, mechanical stability is of paramount concern. How you construct the mechanical aspect of the circuit can make the difference between a wobbler and a rock-solid VFO.

Shield the VFO from outside sources of energy. This is very important! Double-sided PC board is a cheap, dirty and very effective shielding material. Small metal boxes are also suitable for VFO oscillator shielding.

Keep the output of the oscillator away from the input; we don't need any additional feedback loops! Keep the output away from power supplies, digital sources and other noise generators.

Use only high quality, temperature-stable components in your VFO circuits. If you use junk parts, you'll get junk-part results. Use only NPO type capacitors, along with polystyrene and silver mica capacitors.

If you remember these three basic oscillator circuits, you'll be on your way to understanding more of the magic of radio! RF

advertiser index

Missing Person

New Jersey father asks ham radio operators to help spread word about missing children.

CAPE MAY—On November 25, 1991, (then) 11-year-old Mark Himebaugh vanished without a trace from the area of his home in Cape May County, New Jersey. A massive search and the ensuing investigation have uncovered nothing. Mark is still missing—an apparent victim of abduction.

Shortly after Mark disappeared, Mark's dad, Jody (KB2QGJ), met with John Walsh of television's America's Most Wanted, whose own son, Adam, had been abducted 12 years ago and was later found murdered. Walsh charged Himebaugh with the responsibility of "keep(ing) Mark's face and situation in the public eye at all times, no matter what it takes!"

Jody soon formed the Friends of Mark Himebaugh Foundation with a stated purpose of heightening and maintaining national public awareness of the issue of missing children and the crime of abduction.

Himebaugh began thinking of ways hams could become involved in the plight of his son and other missing children. One idea was for radio clubs across the nation to adopt local missing children as their community service projects.

"Whenever QSL cards are mailed, include the poster of a missing child," Himebaugh suggested. "During CW, packet, and voice communications, discuss the issue of missing children and the crime of abduction; transmit images of missing children when working SSTV (slow-scan television); and, whenever accessing computer bulletin boards, exchange (upload/download) information about missing children." (On CompuServe, the command GO MISSING gives access to the images of missing children.)

By spreading the word around the globe, maybe someday the heinous crime of child abduction and the ominous rise in the number of missing children can be brought to a halt. To that end, it is the wish of the Himebaugh Foundation that the news media, companies and organizations, and people everywhere will continue to cooperate to help bring these kids home unharmed.

May 25th is annual Missing Children Day, observed across the U.S. and Canada. The Himebaugh foundation would like to see a national special event held on that day to raise awareness. "Instead of just talking about the weather and the height of your antenna, mention the child your club has adopted and communicate what you're doing about recovering children who are missing." Himebaugh proposed.

"On a national level," concluded Himebaugh, "nothing is being done to bring attention to the hundreds of thousands of kids out there who are currently missing. Maybe this awareness program is a step in the right direction to change that."

Realistically there are over a million children missing each year. Statistically, there are over 500,000 children listed as missing! Of these, 85-88% are taken by custodial or non-custodial parents.

Then there are children categorized as "runaways," when the child leaves home by choice; and "thrownaways," when the child is told to leave home (i.e. "Get Out!").

The remaining 1%, estimated at between 4,000 and 7,000 children, are victims of what used to be referred to as "stranger abduction": A witness sees the child's abduction, or the child vanishes under suspicious circumstances. The term "stranger" has been reclassified as "non-family type."

Most states have a clearinghouse for missing persons. For further information contact your state police or the National Center for Missing and Exploited Children (NCMEC), 2101 Wilson Blvd., Suite 550, Arlington VA 22201; telephone: 1-703-235-3900.

Himebaugh, with a background in electronics from the National Cash Register Company in Dayton, Ohio, was a signalman during the Vietnam conflict. Said Himebaugh, "I've always wanted to get back into communications but kept putting it off. Because of all the stress that I've been going through, a friend recommended I take up a hobby. Ham radio was a natural choice."

Tech-Plus Himebaugh missed his exam for General in November when he had a stress-related illness that landed him in the hospital. He is scheduled to take the test for both General and Advanced. He's already passed the 13 wpm code requirement.

[You can contact The Friends of Mark Himebaugh Foundation, Inc., at P.O. Box 551, Cape May NJ 08204-0551; (609) 884-6275.] RF

Marketplace

lio Fun Magazine

advertiser index

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By spreading the word around the globe, maybe someday the heinous crime of child abduction and the ominous rise in the number of missing children can be brought to a halt. To that end, it is the wish of the Himebaugh Foundation that the news media, companies and organizations, and people everywhere will continue to cooperate to help bring these kids home unharmed.

May 25th is annual Missing Children Day, observed across the U.S. and Canada. The Himebaugh foundation would like to see a national special event held on that day to raise awareness. "Instead of just talking about the weather and the height of your antenna, mention the child your club has adopted and communicate what you're doing about recovering children who are missing." Himebaugh proposed.

"On a national level," concluded Himebaugh, "nothing is being done to bring attention to the hundreds of thousands of kids out there who are currently missing. Maybe this awareness program is a step in the right direction to change that."

Realistically there are over a million children missing each year. Statistically, there are over 500,000 children listed as missing! Of these, 85-88% are taken by custodial or non-custodial parents.

Then there are children categorized as "runaways," when the child leaves home by choice; and "thrownaways," when the child is told to leave home (i.e. "Get Out!").

The remaining 1%, estimated at between 4,000 and 7,000 children, are victims of what used to be referred to as "stranger abduction": A witness sees the child's abduction, or the child vanishes under suspicious circumstances. The term "stranger" has been reclassified as "non-family type."

Most states have a clearinghouse for missing persons. For further information contact your state police or the National Center for Missing and Exploited Children (NCMEC), 2101 Wilson Blvd., Suite 550, Arlington VA 22201; telephone: 1-703-235-3900.

Himebaugh, with a background in electronics from the National Cash Register Company in Dayton, Ohio, was a signalman during the Vietnam conflict. Said Himebaugh, "I've always wanted to get back into communications but kept putting it off. Because of all the stress that I've been going through, a friend recommended I take up a hobby. Ham radio was a natural choice."

Tech-Plus Himebaugh missed his exam for General in November when he had a stress-related illness that landed him in the hospital. He is scheduled to take the test for both General and Advanced. He's already passed the 13 wpm code requirement.

[You can contact The Friends of Mark Himebaugh Foundation, Inc., at P.O. Box 551, Cape May NJ 08204-0551; (609) 884-6275.] RF

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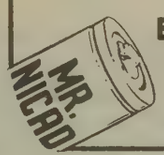

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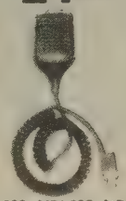

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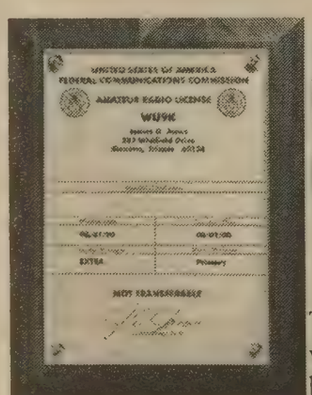

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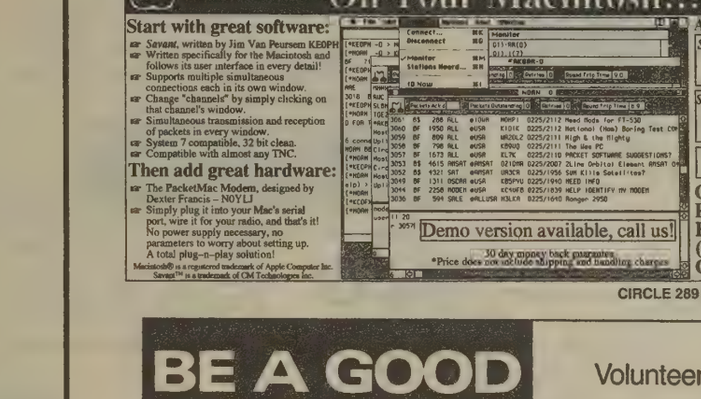

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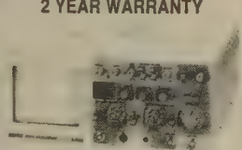

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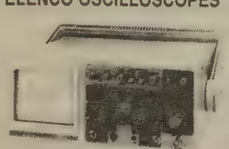

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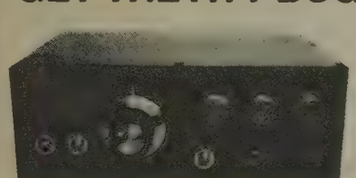

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antennas, etc.

by Joseph J. Carr K4IPV

The Windom Antenna

One of the problems faced by many operators is the need for a multiband high frequency antenna while on a budget. While anyone with a large bundle of cash can make it happen, what does one do when the cash is a trifle limited? One answer (there are several) to that question is found in the Windom antenna.

The Windom antenna (Figure 1) has been a popular multiband wire antenna design since the 1920s. Although Loren Windom is credited with the design, there were actually a number of contributors. Co-workers with Windom at the University of Illinois were John Byrne, E.F. Brooke, and W.L. Everett, and they are properly co-credited. The designation of Windom as the inventor was probably due to the publication of the idea (credited to Windom) in the July 1926 issue of *QST* magazine. Additional (later) contributions were rendered by G2BI and GM1IAA (Jim MacIntosh). We will continue the tradition of crediting Loren Windom with the understanding that others also contributed to this antenna design.

The Windom is a roughly half-wavelength antenna that will also work on even harmonics of the fundamental frequency. The basic premise is that the antenna impedance varies from about 50 ohms to about 5,000 ohms, depending on the selected feed point. When fed in the exact center, a current node, the feed-point impedance will be 50 ohms; similarly, end-feeding the antenna finds a feed-point impedance of about 5,000 ohms. In Figure 1 the feed point is tapped away from the center at a point that is about 0.18 the way from one end, at a point where the impedance is about 600 ohms.

The Windom antenna works well . . . but with some caveats. For example, the antenna has a tendency to put "RF in the shack" because it is voltage-fed. Second, there is some radiation loss from the feedline. Finally, the antenna works poorly on odd harmonics of the fundamental frequency.

> ***"The Windom is a roughly half-wavelength antenna that will also work on even harmonics of the fundamental frequency."***

The antenna tuning unit can be a parallel resonant, link-coupled, LC tank circuit; a reversed pi-network; or a wide-range antenna tuning unit (ATU). In the case of the Windom, the pi-network is turned around backwards from the usual configuration: The input is at the low impedance end of the network, and the output is at the high impedance end. Design a pi-network (using my Antlers and Zmatch software) to match 50 ohms on the transmitter end and 600 ohms on the antenna end.

Construction of the simple 1920s vintage Windom antenna is relatively simple. Cut a half wavelength section of #14 or larger antenna wire (Copperweld works best) and measure 0.18 from one end. To find the overall length in feet, use the formula $L_{feet} = 468/F_{MHz}$. The distance to the feed point is found from $168.5/F_{MHz}$. In both cases, the lengths are in feet and the frequencies are in megahertz (MHz). The frequency to use is the lowest operating frequency contemplated. For 75/80 meters use 3.5 MHz, which makes the overall length 133' 8", and the feed point 48' from one end.

The feedline or "down lead" is a single conductor of at least the same gauge as the radiator element wire (e.g. #14). Mechanical integrity will be best if stranded wire is used, and the down lead should be insulated (the radiator element can be insulated, but that isn't necessary in most cases).

A reasonable compromise Windom that reduces feedline radiation losses is shown in Figure 2. In this antenna a 4:1 balun transformer is placed at the feed point, and this in turn is connected to 75 ohm cable coaxial transmission line to the transmitter. A transmatch or similar ATU is connected between the transmitter and the transmission line in order to flatten out variations in the VSWR as seen by the transmitter.

Either form of Windom should be installed so that it is horizontal, and straight. Performance of any wire antenna suffers when it is bent to fit a space, although if that's what you've got to do then do it. Also, the feedline of a Windom should come away from the radiator element as close to a right angle as possible.

Windom antenna parts and complete kits, including the Carolina Windom design, can be found at Radio Works [Box 6159, Portsmouth, VA, 23703; 804-484-0140 (voice) or 804-483-1873 (fax); catalog $4].

Information on additional forms of nontraditional but effective wire antennas can be found in both of my antenna books: *Practical Antenna Handbook* (TAB/McGraw-Hill Cat. No. 3270, Blue Ridge

Summit PA 17294:1-800-233-1128), and *Receiving Antenna Handbook* (HighText Publications, order via IPG at 1-800-888-4741).

Software Anyone?

If you have access to an MS-DOS or Windows-compatible personal computer, then you might be interested in the Antlers software disk. Several directly executable programs are found on the disk:

ANTLERS: This program calculates the lengths of the elements for a wide variety of wire, vertical and beam antennas. It also calculates the inductance of loop antennas, and the capacitance needed to resonate at any given frequency.

LCTANK: Calculates the values of inductor-capacitor-tuned RF circuits.

LOADPOLE: Calculates the inductance value needed to resonate a shortened inductance-loaded dipole.

LOOP-2 and LOOP-3: Calculates the inductance of loops and the capacitance needed to resonate.

OVENCOLO: A computerized "scientific experiment" to teach experimenting from a statistical point of view.

STATS: Logs data to disk, and performs standard deviation, variance, and mean calculations.

ZMATCH: Calculates the inductance and capacitance needed to make an antenna tuning unit.

To run any of these programs, place the disk in the disk drive and type the drive label and name; e.g. to run ANTLERS type "A:ANTLERS" when the disk is in the A: drive, or "B:ANTLERS" when it's in the B: drive.

I can supply Antlers for $20 (POB 1099, Falls Church VA 22041). It is not copy-protected. Although it is copyrighted, the label allows unlimited NON-COMMERCIAL copying, so if several of your friends are interested, order just one copy and make copies for them . . . for free (if you sell the copy, I want my cut). RF

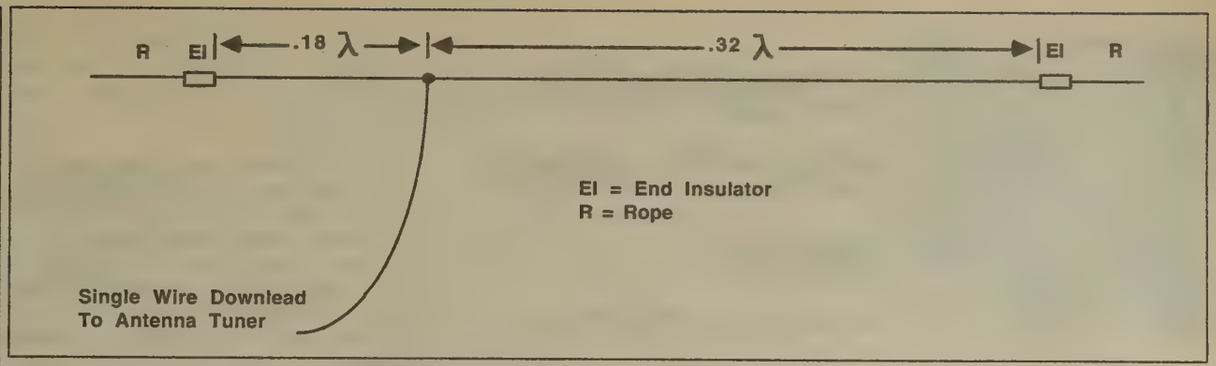

Figure 1. The basic Windom antenna design.

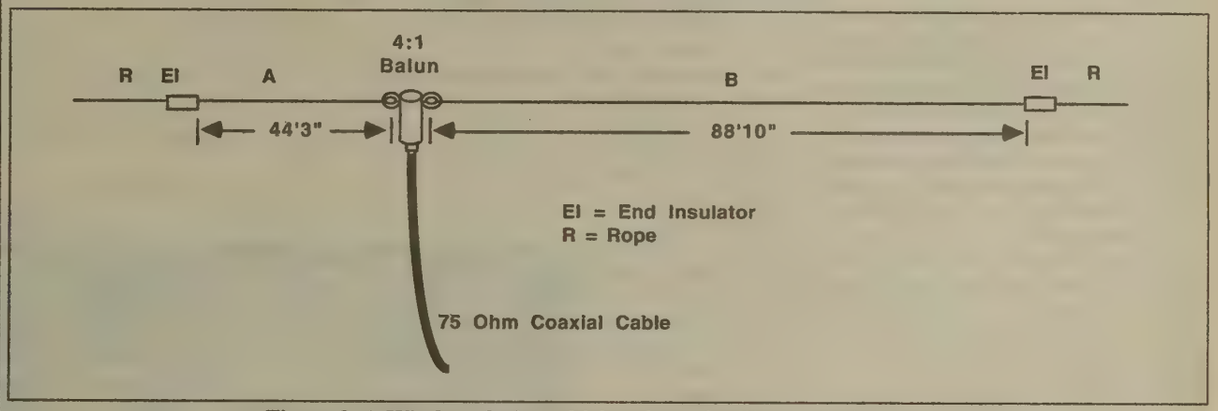

Figure 2. A Windom design which reduces feedline radiation losses.

Easy Tilt-Over Tower

by Edward Oros AC3L

Here's a fantastic project for those of you who love to experiment with antennas. Radio Shack has a great little device called a "Telescoping Antenna Mast Roof Mount Base." Although it was designed for roof mounting, and is quite useful as such, I've found that it's easy to use it as a ground-mounted base for erecting tilt-over towers and antennas.

Photo A. A ground-mounted vertical, using one of the bases and supported by a small tree.

Parts

You'll need just a couple of parts in order to install your ground-mounted base. First, of course, is the base itself, model number 15-5068A. Next, you'll need to visit your local hardware store to find a threaded rod. The type you are looking for is entirely threaded from one end to the other. These rods are available in three-foot and six-foot lengths, and in a variety of diameters. The rods will be driven into the ground through the 7/16" holes on either side of the base mount. If you'd like the rods to double as ground rods, chose two of the six-foot lengths; otherwise, the shorter rod will suffice. As long as your soil isn't loose or sandy, you should be able to get by with a foot and a half for each side. This is the length I commonly use.

Bolt cutters or a hacksaw can be used to cut the three-foot rod if you choose to use this length. As for the correct diameter of the rod, you can choose any size that will fit through the 7/16" holes of the base, but I've found that the quarter-inch diameter rods fit the bill nicely. While at the hardware store, also pick up four stainless steel nuts. The size will depend on the rods you choose. Test the nuts before you leave the store to be sure they will easily screw onto the rods.

Installation

Next, it's back home to find a spot to install your base. When selecting a location, keep in mind the direction that the mast will tilt and be sure that it is clear of power lines, trees and other obstacles.

As with any tower structure, another important consideration is installing the guy wires for the mast. If positioned correctly, buildings and some trees can make excellent "easy install" sites. Photo A shows a ground-mounted vertical, using one of Radio Shack's bases and supported by a small tree.

Once the location is determined, clear the ground area of stones and sticks in order to make the spot as level as possible. Screw on the nuts, with two on each rod, and position them about four inches below the top end of the rods. The nuts must be installed first because driving the rod will damage the threads and it will be impossible to screw them on afterwards. Position the base on the ground and insert the rod. In order to ensure that the base is grounded, scrape the area around the 7/16" holes until the bare metal is exposed. Then use a hammer to drive the rod through the hole into the ground until the bottom nut reaches the base. Tighten it against the plate with a wrench. Then do the same to the other side.

Photo B shows the base installed in this manner. The top nut on each side is there to provide a method of securing any ground wires that you may wish to use. If no ground wires or radials will be used, the top nuts should be tightened against the bottom ones to prevent the lower ones from loosening over time.

The base also comes supplied with a pin which is designed to be inserted through a hole drilled near the base of the mast. Radio Shack also carries masts which already have the hole drilled (Model numbers 15-5065 and 15-5067), or you can modify your own masts by drilling a 3/8" hole yourself right at the bottom of the mast.

When using the pin that comes with the base, the mast will be grounded through the metal pin to the base and the rods. If you prefer, you can also substitute the supplied pin with some non-metallic material such as a plastic pin or wooden dowel rods. This insulates the mast from ground and then you can directly feed the mast as a ground-mounted vertical.

To date I've used the bases for a multitude of purposes. I've created quarter-wave verticals, ground-mounted vertical beams, masts to hold dipole ends, supports for beams and verticals, etc. I'm sure the possibilities are endless. RF

Photo B. The installed base.

upgrade . . . don't stop now

by Gordon West WB6NOA

Computer Fun With Your Ham Rig

If you have a computer, chances are you have been using it to help earn your amateur license and your next upgrade. Relatively inexpensive software to use your computer to study both code and theory is available from the W5YI Group (800-669-9594). That's for PC-type computers. For the Mac, equally impressive code and theory programs are available to get you into the study mode at home or at the office.

For your VHF station, you probably have already tied your computer into a terminal node controller for packet, AMTOR and other digital receiver modes. In fact, if you just want to look in on digital modes with your home computer, software from Software Systems Consulting (714-498-5784) packs all of the analog-to-digital conversion right in the plug assembly that goes into the back of your laptop or home computer, and you can tune in to WEFAX, RTTY, CW, and AMTOR broadcasts with no external TNC required. All that for $100, too!

Then there is the amateur radio data base, available on disk or CD-ROM. No direct hookup is necessary to your ham set, but keep it handy—it's a great way to prepare QSL information, or to determine legitimate callsigns by asking for the operator's birthday.

If you are still searching for a closer tie-in between your home or laptop computer and your ham radio high frequency station, take a look at HamWindows Version 2.3 or HamWindows Plus in operation. It's awesome.

Turn the chore of QSLs and logging into one swift process which connects to the *Callbook* and many other data bases for data lookup. Turn your TNC into a Windows digital communications screen, and quickly look up gray-line opportunities for great DX.

If you're into shortwave listening, the HamWindows data base of over 9,000 SWL frequencies lets you listen in on the world, while simultaneously looking at the world factbook and information about each and every country you have tuned in.

You can even go one step further and control your radio directly from your computer's screen. Create your own radio face panel, and interface it directly to any Kenwood, ICOM, or Yaesu transceiver. Graphic radio components include a live S-meter, functional keypads, digital displays, and all of the indicators indicating modes, RIT settings, and the like. Unfortunately, it's not quite at the level of a touch-screen operation, but you can click on quickly to the parameters you want to change, and you are indeed on the air using your computer and your radio set off in the corner.

"For school and classes, this type of computer interface with a built-in world atlas is just what we need for our CQ All Schools Net," comments Carole Perry WB2MGP, instructor for Intermediate School 72 in Staten Island, New York. "Clearly, the computer's impact on communications is upon us, and as in the past, schools and the amateur radio community need to lead the way—this is why it's inevitable that the computer will become the center of any full-blown ham station," adds Perry.

But to run HamWindows, you will need plenty of computer power and memory on your present PC setup:

- 386 or faster
- 4 megabytes of RAM on the board and VGA monitor and card for HamWindows 2.3
- 8 megabytes of RAM and a Super VGA monitor and card for HamWindows Plus

Here at Radio School, we came up with everything already in our computer other than the 4 megabytes of RAM. As long as we were in there, we loaded 8 megabytes, and now we are all set to work with the CQ All Schools Net, on the air, with HamWindows.

Best of all, kids are interested in computers first, and might consider ham radio as their next step when they see the tie-in. It's worked for CQ All Schools, and it very well could create renewed enthusiasm in the amateur radio service to the kids around the house who may know more about computers than you and me!

Your computer, tied to your ham set—some interesting possibilities! RF

Photo A. Turn your computer into an interactive ham set! Your computer can now run your rig.

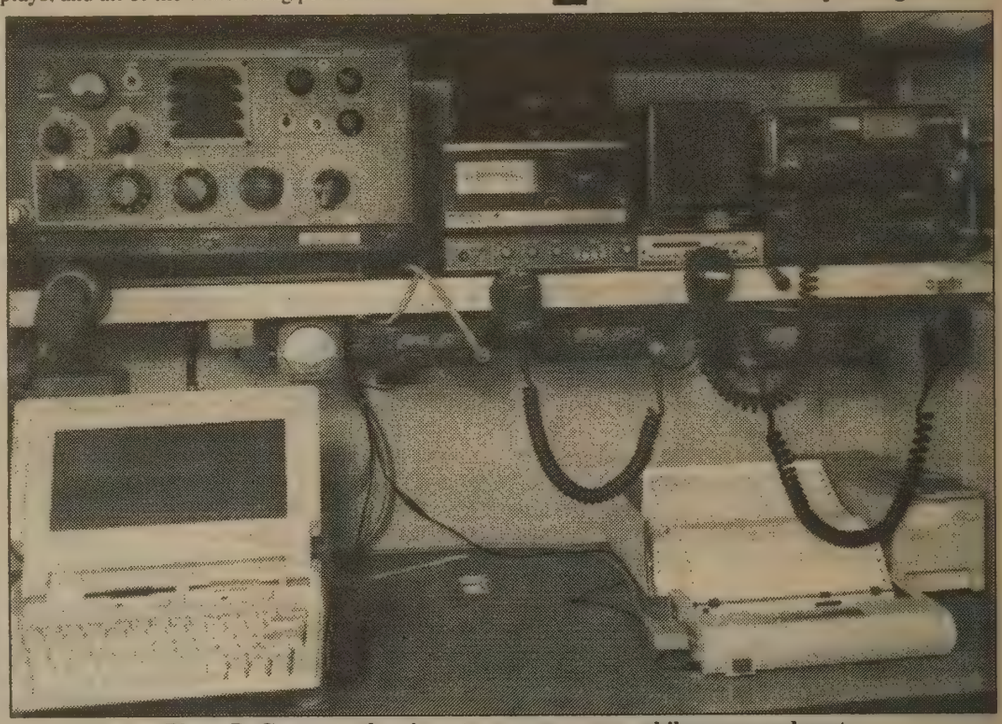

Photo B. Computer logging at an emergency mobile command post is a great use of HamWindows.

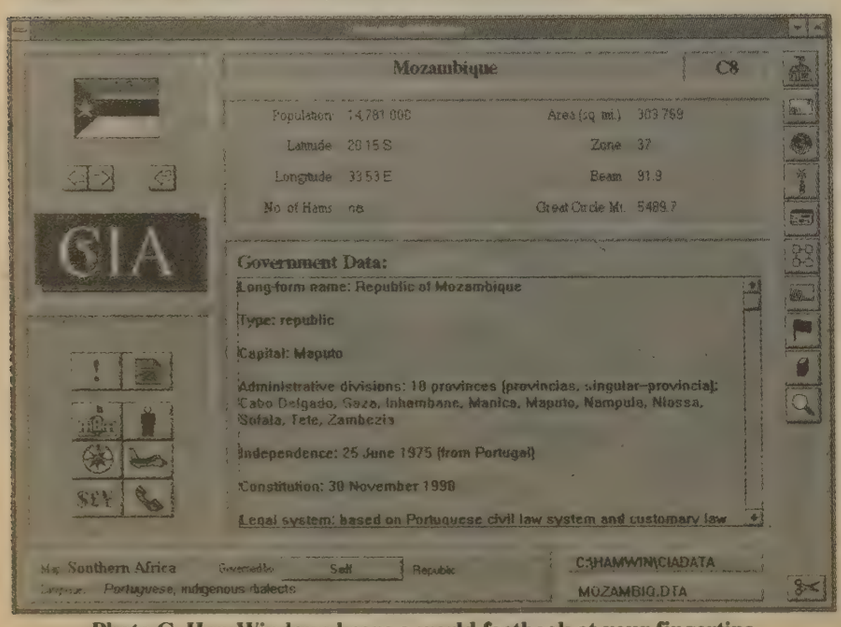

Photo C. HamWindows keeps a world factbook at your fingertips.

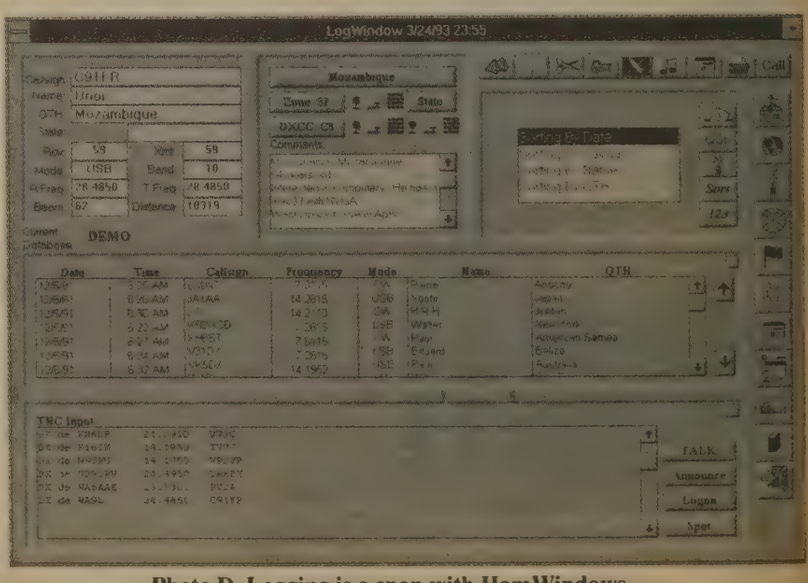

Photo D. Logging is a snap with HamWindows.

what's next?

by Carole Perry WB2MGP

Two Holiday Stories

As a teacher of sixth-, seventh- and eighth-graders for over 13 years I've been part of many wonderful experiences with my students. Due to the fact that I teach *amateur radio* to these students, my experiences are often quite spectacular and almost always out of the ordinary.

An Exciting Contact

Last term, right around the December holidays, two terrific things happened that I'll share with you. Norman Calta is one of my special education youngsters who is mainstreamed into my sixth-grade radio class. Norman has several learning disabilities but clearly brings his whole heart and soul into my classroom activities involving radio. One day Norman gave me his uncle's phone number and told me that he was a ham radio operator. Not fully believing that this coincidence was real, I phoned Uncle Tony KO4ZB in Georgia.

Sure enough, Norman does indeed have an uncle and an aunt who are hams. Everyone involved was so excited for Norman. We, of course, arranged for a 40 meter contact the next week. I wanted Norman to enjoy basking in his newly-found "celebrity" status. For several days, this sweet little boy enjoyed all the attention we all paid to him. After all, it was *his* uncle we were going to try to contact.

When the big day came, Norman poked his head in my doorway several times to make sure I remembered the scheduled contact time. The reader would understand the expression "walking on a cloud" if you could have seen Norman walking across my room to the radio station. What a proud moment for this super youngster. Uncle Tony and Aunt Merry KE4FIW had a wonderful QSO with their nephew and wished him a happy holiday. The size of the smile on Norman's face that day was surpassed only by the grin we saw when he hung up the QSL card a week later. This teacher left the school at the end of the day totally teary-eyed, knowing that Norman would remember his magical moment forever.

Upcoming *Endeavour* Launch

Another great holiday story took place when I received an invitation to attend the launch of the STS-59 this coming April. Naturally I was thrilled. But I was especially excited to learn that I could bring a few people with me. I decided to have my own children attend, of course, and also one of my "other" children—one of my students.

I held a contest among my ham radio students. Those children who were presently in my program or who had previously spoken to astronauts on the CQ All Schools net were asked to write an essay about why they wanted to see the launch of the *Endeavour*. Based on their responses and on my personal knowledge of the kids in the classroom, a terrific eighth-grade girl, Renée Hoehn KB2QMR, was chosen. Last term, Renée was one of the youngsters who got to participate in the Ocean Challenge project by speaking with Rich Wilson WA1BZE during the ocean voyage, and then meeting him in person at the New York City Seaport.

Needless to say, hundreds of my students wanted to go to the launch. The contest certainly heightened interest in the shuttle program. The rest of the school also had a chance to see what really special things happen to kids in the radio program. Renée and her mom, who will be going along also, agree that this is the opportunity of a lifetime. There is no doubt in my mind that Renée will remember her experience at the Kennedy Space Center for the rest of her life.

There are many terrific youngsters out there doing fun things with amateur radio. If you know anyone under the age of 18 who is an articulate, enthusiastic speaker who would like to participate in the Dayton Youth Forum this April, please have them contact me at (718) 983-1416 or write to me at P.O. Box 131646, Staten Island NY 10313-0006. RF

Photo A. Left to right: Renée KB2QMR and runner-up for the launch trip, Rose KB2QMK.

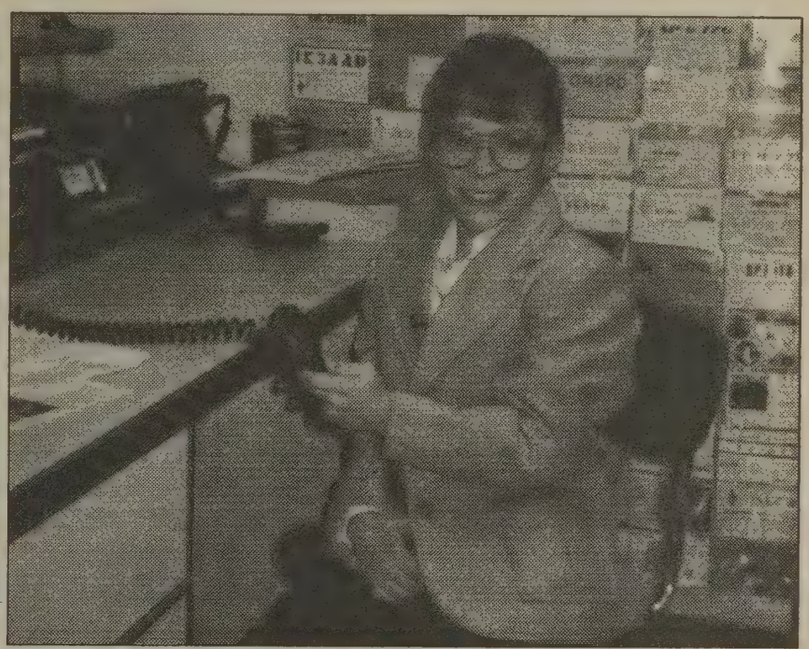

Photo B. Sixth-grader Norman Calta speaking with his uncle Tom KO4ZB.

Radio Fun flea market

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The *Radio Fun Flea Market* costs you peanuts (almost)—comes to 25 cents a word for individual (non-commercial) ads, and 80 cents a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad. This is a monthly magazine, not a daily newspaper, so figure a couple of months before the action starts; then be prepared. If you get too many calls, you priced it too low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right, and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using.

Send your ads and payment to *Radio Fun Flea Market*, Judy Walker, 70 Route 202 N, Peterborough NH 03458, and *get set for the phone calls.*

The Deadline for the May 1994 Flea Market Is February 18, 1994.

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PRINTED CIRCUIT BOARDS for projects in *73, Ham Radio, QST, ARRL Handbook*. List, SASE. **FAR CIRCUITS,** 18N640 Field Ct., Dundee IL 60118. RF595

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activities calendar

Send your announcements to: Radio Fun Activities Calendar, 70 Route 202-N, Peterborough NH 03458. We'll print as many as space allows, on a "first come-first listed" basis.

MARCH 20

CIRCLEVILLE, OH The TEAYS ARC will sponsor a Hamfest/Computer Show in the Grange Bldg., Pickaway County Fairgrounds, 415 Lancaster Pike (US22 East), starting at 7 AM (Set-up at 6:30 AM). Talk-in on .52/.52 and 147.78/.18. Contact *Dan Grant W8UCF, 22150 Smith-Hulse Rd., Circleville OH 43113. Tel. (614) 477-3026.*

APRIL 2

COLUMBUS, IN The Columbus ARC will host a Hamfest at Bartholomew County 4-H Fair Grounds, Family Arts Bldg., on State Rd. 11, from 8 AM-2 PM. Talk-in on 146.790/146.190. Make reservations thru *Marion Winterberg WD9HTN, 11941 W. Sawmill Rd., Columbus IN 47201. Tel. (812) 342-4670.*

LONGMONT, CO The Longmont ARC will hold its annual LARCFEST from 8 AM-3 PM at the Boulder County Fairgrounds. Hover and Nelson Rds. VE Exams at 1 PM. Talk-in on 147.27/.87 or 146.52. Contact *Randy Stevens N0NMD, 5280 Cypress Dr., Boulder CO 80303. Tel. (303) 499-1106.*

APRIL 9

LAWTON, OK The Lawton Ft. Sill ARC will hold the 48th annual LFSARC HAMFEST from 8 AM-5 PM at the Comanche County Fairgrounds in Lawton. Talk-in on 146.91/.31. Write to *Bob Morford KA5YED, 1415 N.W. 33rd St., Lawton OK 73505*; or call *(405) 355-6120.*

ROCHESTER, MN The Rochester Area Hamfest/Computer & Electronic Show will begin at 8 AM at John Adams Jr. H.S., 1525 31st St. NW. Talk-in on 146.22/.82 (W0MXW Rptr.); 223.22/224.32 (W0MXW Rptr.). Contact *Rochester ARC, Attn: Colleen Vaneps N0ZDY, 707 11 1/2 St. SW, Rochester MN 55902. Tel. (507) 280-9102.*

APRIL 10

MADISON, WI The Madison Area Repeater Assn., Inc., will hold its 22nd annual Madison Swapfest at the Dane County Exposition Center Forum Bldg. beginning at 8 AM. (Set-up 7 AM). Talk-in on 147.75/.15 on the M.A.R.A. Rptr. (WB9AER). Reservation deadline is March 31st. Write to *M.A.R.A., P.O. Box 8890, Madison WI 53708-8890*; or call *Jim Waldorf KB9AQQ, (608) 249-7579.* Leave a message on the answering machine.

TRENTON, NJ The Delaware valley Radio Assn. will sponsor HAMCOMP '94, their 22nd annual Flea Market of amateur radio and computer equipment. The event will be held from 8 AM-1 PM on the campus of Trenton State College, Route 31, Ewing Township, Trenton NJ. Wheelchair accessible. Talk-in on 146.07/.67. Contact *HAMCOMP '94, P.O. Box 7024, West Trenton NJ 08628. Tel. (609) 882-2240.*

SPECIAL EVENT STATIONS

APRIL 3-9

TWEED HEADS, N.S.W., AUSTRALIA Station VI2CQ will operate approx. 2300 UTC-0000 UTC and 0300 UTC-0500 UTC from Camp Quality (Kids with Cancer), in the Tweed Heads area of NE New South Wales. It will be manned mainly by the VK4 Gold Coast ARS Inc. Frequencies: 7.050, 14.150, 21.150 and 29.550, all +/- QRM. QSL via *VK2CYI, VK2 Bureau*. A QSL card will be sent for all contacts.

APRIL 7

GLENBROOK, N.S.W. In commemoration of the 140th Anniversary of the first morse telegraph circuit in Australia (between Melbourne and Williamstown), the Sydney Morsecodians Fraternity will establish a morse link between Melbourne and Williamstown (with the venues at each end yet to be identified). The Science Centre in Canberra will be linked with both terminals so that messages may be exchanged between the three centers. Visitors will be able to send brief telegrams to relatives or friends, without charge.

APRIL 30-MAY 1

PHILADELPHIA, PA The Olympia ARC will operate WA3BAT from 1300Z April 30th-2000Z May 1st, to commemorate the 96th Anniversary of Admiral Dewey's triumph over the Spanish fleet at the Battle of Manilla Bay. SSB/Phone—3.898, 7.268, 14.268, 21.368, 28.368, 145.270, and packet. For a certificate, send QSL and a 9x12 SASE to *Olympia ARC, P.O. Box 928, Philadelphia PA 19105.*

Uncle Wayne's Bookshelf

BOOKS FOR BEGINNERS

02D42 **Digital Novice** *by Jim Grubbs* Geared to make you a more knowledgable participant. **$8.50**

01A87 **Shortwave Listener's Antenna Handbook** Primer antenna theory. **$13.95**

05C25 **Basic A.C. Circuits** A step-by-step approach for the beginning student. **$24.50**

20N018 **Technician Class License Manual: New No-Code** *by Gordon West* This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. **$9.95**

20N092 **The Wonderful World of Ham Radio** *by Richard Skolnik, KB4LCS* Simple, clear, and fun. Introduces young people to amateur radio. **$7.95**

20N100 **Electronics Build and Learn (2nd Ed.)** *by RA Penfold* Combines theory and practice so that you can "learn by doing." **$12.50**

20N099 **Digital Electronics Projects for Beginners** *by Owen Bishop* Contains 12 digital electronics projects suitable for the beginner to build with the minimum of equipment. **$12.50**

AR2871 **W1FB's Help for New Hams** *by Doug DeMaw W1FB* Complete for the newcomer. Put together a station and get on the air. **$10.00**

AR2286 **First Steps in Radio** *by Doug DeMaw W1FB* Series of *QST* articles. **$5.00**

SHORTWAVE

06S57 **1993 Passport to World Band Radio** *by International Broadcasting Services, Ltd* You'll get the latest station and time grids. **$16.50**

03S11 **Shortwave Receivers Past and Present** *edited by Fred J. Osterman* Guide to 200+ shortwave receivers manufactured in the last 20 years. The Blue Book of shortwave radio value. **$8.95**

07R25 **The RTTY Listener** *by Fred Osterman* New and expanded. This specialized book compiles issues 1 through 25 of the *RTTY Listener Newsletter*. Contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. **$19.95**

03C09 **Shortwave Clandestine Confidential** *by Gerry L. Dexter* Covers all clandestine broadcasting, country-by-country; tells frequencies, other unpublished information: spy, insurgents, freedom fighters, rebel, anarchist radio, secret radio. **$8.50**

03M221 **US Military Communications (Part 1)** US Military communication channels on shortwave. Covers frequencies, background on point-to-point frequencies for the Philippines, Japan and Korea, Indian and Pacific Oceans, and more. **$12.95**

03M222 **US Military Communications (Part2)** Covers US Coast Guard, NASA, CAP, FAA, Dept. of Energy, Federal Emergency Management Agency, Disaster Communications, FCC, Dept. of Justice. From 14 KC to 9073 KC. **$12.95**

03M223 **US Military Communications (Part 3)** Completes the vast overall frequency list of US Military services, from 8993 KC to 27,944 KC. **$12.95**

09S42 **The Scanner Listener's Handbook** *by Edward Soomre N2BFF* Get the most out of your scanner radio. **$14.95**

11T88 **Tune in on Telephone Calls** *by Tom Kneitel K2AES* Formatted as a frequency list with detailed description of each service and its location in RF spectrum. **$12.95**

03K205 **Guide to Radioteletype (RTTY) Stations** *by J. Klingenfuss* Updated book covers all RTTY stations from 3MHz-30MHz. Press, Military, Commercial. Meteo. PTTs, embassies, and more. **$12.95**

11AS10 **Air Scan Guide to Aeronautical Communications (5th Ed.)** *by Tom Kneitel K2AES* Most comprehensive guide to monitoring US aeronautical communications. Covers all Canadian land airports and seaplane bases, plus listings for Central America, the Caribbean, North Atlantic, and the Pacific Territories. **$14.95**

15A002 **Scanner and Shortwave Answer Book** *by Bob Grove* Most frequently asked questions by hobbyists. **$13.95**

07A66 **Aeronautical Communications Handbook** *by Robert E. Evans* Exhaustive, scholarly treatment of shortwave aeronautical listening. **$19.95**

11RF13 **The "Top Secret" Registry of US Government Radio Frequencies (7th Ed.)** *by Tom Kneitel K2AES* This scanner directory has become the standard reference source for frequency and other important information relating to the communications of federal agencies. **$19.95**

11F52 **Ferrell's Confidential Frequency List, New Revised Edition** *compiled by A.G. Halligey* All frequencies from 4 MHz-28MHz covering ship, embassy, areo, Volmet, Interpol, numbers, Air Force One/Two, more. **$19.50**

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CODE TAPES

73T05 **"Genesis"** **$5.95**
5 wpm—This beginning tape. takes you through the 26 letters, 10 numbers, and necessary punctuation. complete with practice every step of the way.

73T06 **"The Stickler"** **$5.95**
6+ wpm—This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are set at 13 wpm and spaced at 5 wpm.

73T13 **"Back Breaker"** **$5.95**
13+ wpm—Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per.

73T20 **"Courageous"** **$5.95**
20+ wpm Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per.

Uncle Wayne's Bookshelf Order Form

You may order by mail, telephone, or fax. All payments are to be in US funds. Allow 3 weeks for delivery.

Item #	Title	Qty.	Price	Total

Shipping: All US/Canada orders add $5.00 shipping. U.S. orders shipped UPS. (Please provide street address.) (Alaska & Hawaii shipped via mail.) Airmail to Canada by actual weight.
Make checks payable to "Uncle Wayne's Bookshelf."
Foreign Orders: Shipping charges by actual weight. Surface or Airmail (Surface delivery may take 2 to 3 months.)

SHIPPING _____
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TOTAL $ ☐AE ☐MC ☐VISA ☐Check/Money Order

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Mail: *73 Magazine*, Attn. Uncle Wayne, PO Box 3080, Peterborough, NH 03458
Telephone: (603) 924-4196 (800) 234-8458 FAX: (603) 924-8613 RF0494

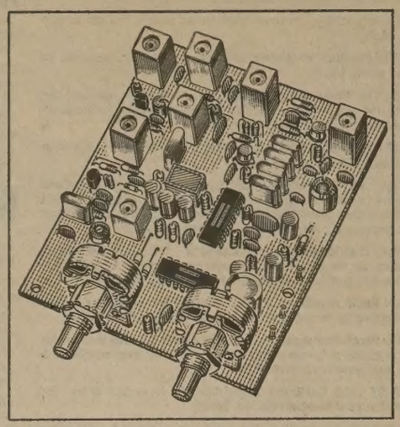
new products

HAMTRONICS, INC.

Hamtronics has announced a program to encourage every ham to build some of his own equipment. Today's technology makes it difficult to acquire the specialized parts and information to build many projects. The answer, of course, is kits.

Hamtronics has announced a spring sale on kits for the express purpose of encouraging those who have not yet built any of their own equipment. Mention that you saw this announcement in *Radio Fun*, and you will be entitled to receive a complete catalog and sale flier with limited-time prices of 10% to 50% off.

Pictured above is the new Hamtronics VHF Monitor Receiver Kit. This new unit is specially suited for monitoring repeaters, amateur calling frequencies, packet, etc. It makes a good starting kit to build, too, because it is easy to assemble and align. For more



information contact *Hamtronics, Inc., 65-F Moul Rd., Hilton, NY 14468-9535; (716) 392-9430; FAX (716) 392-9420.*

ICOM

Icom has introduced the new IC-2GXAT hand-held transceiver, with the highest power in its class, along with a multitude of other advanced features at a very reasonable price. This beauty offers simple operation, advanced features and durable construction.

You can operate the IC-2GXAT 2 meter HT by channel number only, if you wish—keeping frequencies secret, restricting frequencies, or simplifying operation for an unfamiliar user. Other features include auto repeater operation, tone scan, DTMF redial, and a user-friendly keyboard.

For further information visit your local Icom dealer or contact *Icom America, Inc., 2380 116th Ave. NE/P.O. Box C-90029, Bellevue, WA 98009-9029; (206) 454-7619; Telex 152210; FAX (206) 454-1509.* Or circle Reader Service No. 201.

AEA

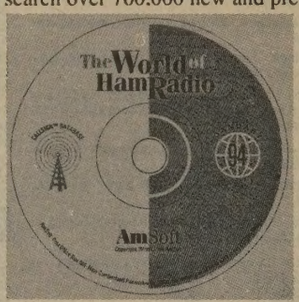
Advanced Electronic Applications, Inc. has announced a PK-232 Gateway Upgrade. With this new firmware in your PK-232, packet digipeating is now a thing of the past. The Gateway firmware functions like <The Net> or NET/ROM; simply connect to your MYGATE callsign.

Once connected, your Gateway firmware supports local "acks" of packets just like a full-service node does. The node supports a variety of useful commands. Switching between PACTOR and AMTOR is automatic!

For more information contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; Upgrade Hotline (206) 774-1722; FAX (206) 775-2340.* Or circle Reader Service No. 202.

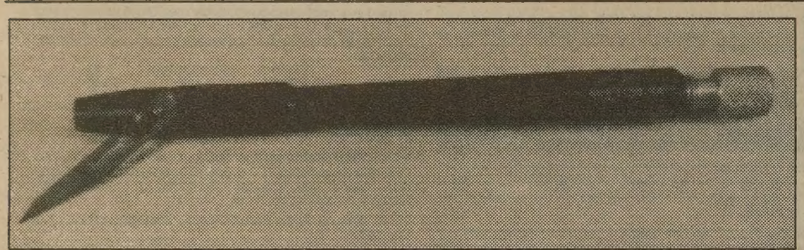
AMSOFT

AmSoft has released its new 1994 edition of "The World of Ham Radio" on CD-ROM. New this year is the inclusion of the FCC amateur radio license database. CALLSIGN will search over 700,000 new and previous callsigns, and find any licensed amateur in just seconds.



Users can view CALLSIGN online or save to disk. Also new for 1994 is a front-end menu system called CDVIEW. CDVIEW will operate the disk with simple onscreen commands, online help files, and instant information files from anywhere within the CD-ROM.

Over 7,000 program files cover many of the latest software releases for amateur radio. Subjects include antennas, CAT, CW, engineering, exams, formulas, logging programs, MUF, multimode, controllers, packet, RTTY, satellites, SWL, weather tracking, and much more. AmSoft has placed all of these programs onto one ISO-9660 IBM compatible CD-ROM priced at $40 plus shipping ($3 USA, $5 foreign). For more information or to order contact *AmSoft, P.O. Box 666, New Cumberland, PA 17070-0666; (717) 938-8249; FAX (717) 938-6767.* Or circle Reader Service No. 203.



THE TOOL RESOURCE

The brand-new Sipel Multi-Blade Knife is now available from The Tool Resource. This knife is the only one of its kind offered in the United States. The patented design allows for a variety of hobby blades, including scalpel.

There is a simple three-step process for the removal and reattachment of blades. These blades have a much longer life than typical hobby blades.

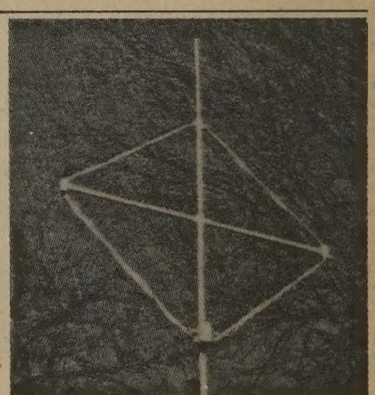
The price for Stainless Steel Knife Part Number M34-SA is $19; Scalpel Blades Part Number M9-15C are $0.90 ea. For more information contact *The Tool Resource, P.O. Box 1106, W. Dundee, IL 60118; Telephone and FAX (708) 468-0849.* Or circle Reader Service No. 204.

CURRY COMMUNICATIONS

Curry Communications has introduced the DX2000 Active Antenna, a professional-grade low frequency broadband antenna covering the LF and VLF frequencies from 3 kHz to 480 kHz. The revolutionary design will improve reception without considerable expense or real estate.

Many hams and other radio enthusiasts enjoy monitoring the LF and VLF bands, receiving European longwave DX, aeronautical beacons, 1750 meters, and other signals of interest. The major drawback is noise. This special antenna optimizes the signals below 500 kHz—especially in urban and suburban environments.

For more information contact *Curry Communications, 737 North Fairview Street, Burbank, CA 91505; (818) 846-0617.* Send SASE to receive free catalog. Or circle Reader Service No. 205.

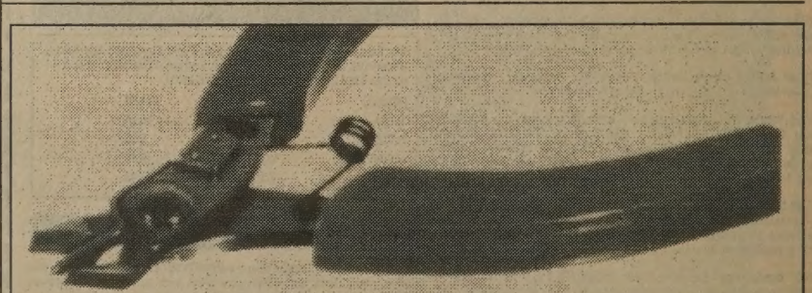


JUST NEON

Did you ever think of having your callsign in neon lights? Well, now you can! Just Neon has introduced its new Neon Call Signs to hams everywhere. These handcrafted works of art last for years and are made out of real neon tubing. Each character is 4" x 3" and signs come with complete instructions, mounting hardware and transformer, custom-made with your callsign.

The ultimate in shack decor is available in neon red, clear blue, orange, white, sky blue, rose, pink, or green. Your sign will be mounted between two durable sheets of clear acrylic and comes with a one-year limited warranty. These signs are also available with a bottom accent strip, border, or other custom design.

The basic custom unit, tested and delivered, is priced at $225. For ordering information, please contact (include an SASE) *Just Neon, 409 James Street, Utica, NY 13501; (315) 724-9150; FAX (315) 792-9032. Or circle Reader Service No. 206.*



RF INDUSTRIES

RFI has announced the stainless steel Gripper Nipper hand tool Model RFA-4084. This unique wire cutter will hold a cut piece of wire firmly in the cutter until it is released by opening the tool. This feature eliminates a major problem with most cutting pliers: small pieces of wire flying from the tool into equipment, where they can cause short circuits.

The RFA-4084 Gripper Nipper is priced at $12 and is available at RFI dealers. For more information contact *RF Industries, Ltd., 7620 Miramar Road, San Diego, CA 92126; (800) 233-1728.* Or circle Reader Service No. 207.

"Built-in VOX? Right!"

"Dual Decode. Now that's a first!"

"Wow, a real Battery Voltage Readout!"

"Yaesu did it again!"

FEATURES	Yaesu FT-530	Kenwood TH-78A	Alinco DJ-580	Icom IC-W-21AT
Memory Channels	82	50	40	70
Slide-out Lithium Battery	YES	NO	NO	NO
Dual CTCSS Decoder	YES	NO	NO	NO
Battery Voltage Readout	YES	NO	NO	NO
Automatic CTCSS Tone Search	YES	NO	NO	NO
Transmit Battery Saver (Repeater & Simplex Operation)	YES	NO	NO	NO
Built-In Vox	YES	NO	NO	NO
One Touch Reverse Button	YES	NO	NO	NO
Dual In-Band Receive (V+V, U+U)	YES	YES	NO	YES
Programmable External Speaker Audio	YES	NO	NO	NO
Optional Digital Display Mic with "S" Meter	YES	NO	NO	NO
AM Aircraft Receive	YES	YES	YES	YES

The Best vs. "the rest".

FT-530
Dual Band Handheld

- **Frequency Coverage:**
  2-Meter 130-174 MHz RX
  144-148 MHz TX
  70 cm 430-450 MHz RX/TX
- 4 TX Power levels:
  w/FNB-25: 2.0, 1.5, 1.0, 0.5W
  w/FNB-27: 5.0, 3.0, 1.5, 0.5W
- DTMF Paging and Coded Squelch
- AOT – Auto On-Timer with built-in clock and alarm functions
- IBS – Intelligent Band Select (provides automatic TX band select on scan stop)
- Backlit keypad and display with time delay
- Built-in cross-band repeat function
- APO – Automatic Power Off
- 5 Watts output w/ FNB-27 battery or 12 VDC
- 2 VFO's for each band
- **Accessories:**

NC-42 1-Hour Desk Charger
FNB-25 600 mAh Battery (2 watt)
FNB-26 1000 mAh Battery (2 watt)
FNB-27 600 mAh Battery (5 watt)
FBA-12 6 AA Cell Holder
CSC-56 Vinyl Case w/ FNB-25
CSC-58 Vinyl Case w/ FNB-26/27
E-DC-5B 12 VDC Adaptor
YH-2 Headset for VOX
MH-12A2B Speaker Mic
MH-18A2B Lapel Speaker Mic
MH-19A2B Mini Earpiece Mic
MH-29A2B LCD Display Mic with Remote Functions
MMB-54 Mobile Mounting Hanger

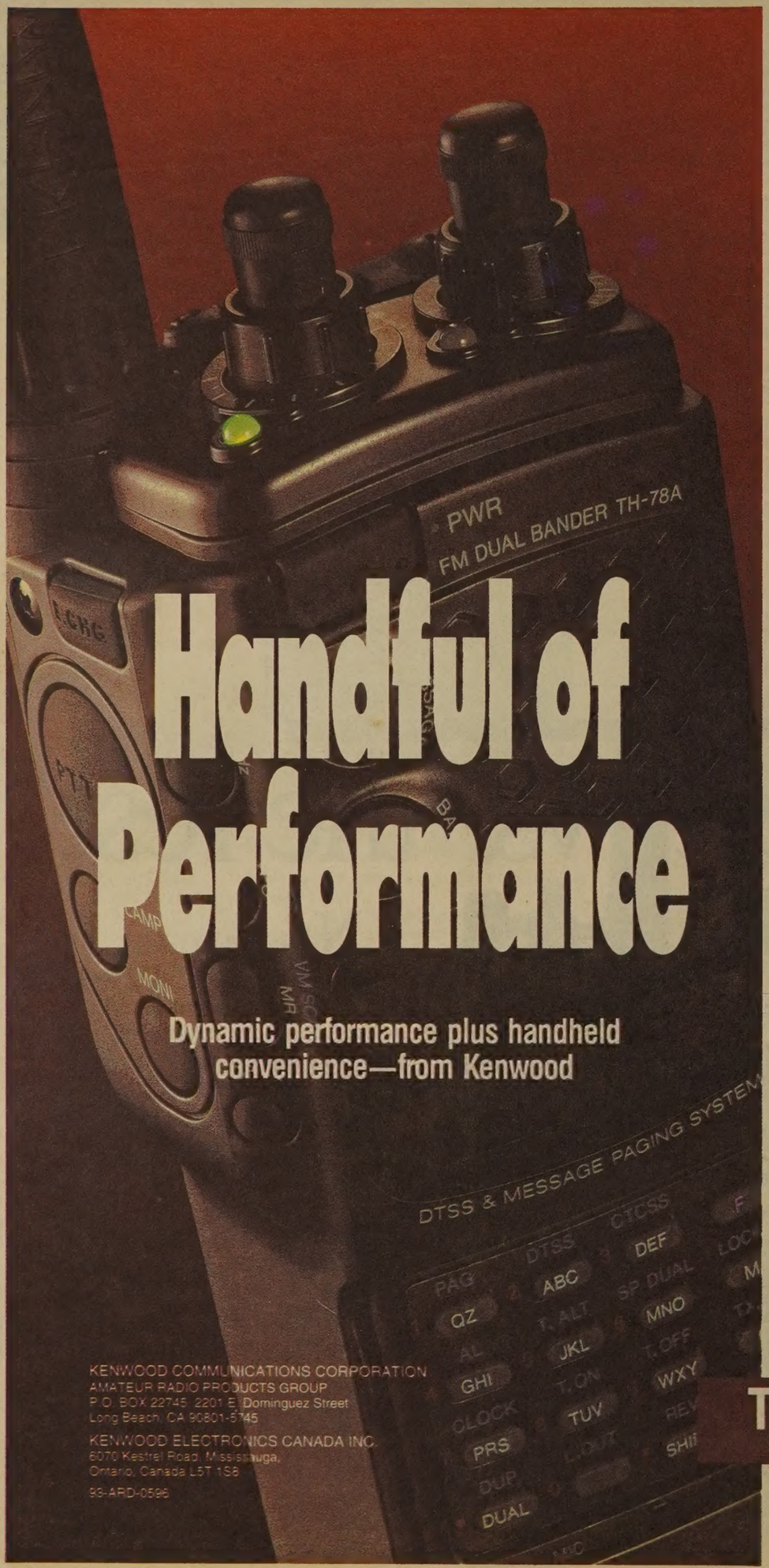
No other dual band handheld beats the FT-530 on features for performance and ease of use. With the largest backlit keypad available, 82 memories, exclusive Dual CTCSS Decode and AM Aircraft Receive, the FT-530 is simply the best value there is.

Compare for yourself, then forget "the rest." See your dealer for the best dual band handheld you can buy. The FT-530.

YAESU

Performance without compromise.℠

Specifications subject to change without notice. Specifications guaranteed only within amateur bands. Some accessories and/or options are standard in certain areas. Check with your local Yaesu dealer for specific details.



Handful of Performance

Dynamic performance plus handheld convenience—from Kenwood

KENWOOD COMMUNICATIONS CORPORATION
AMATEUR RADIO PRODUCTS GROUP
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6070 Kestrel Road, Mississauga,
Ontario, Canada L5T 1S8

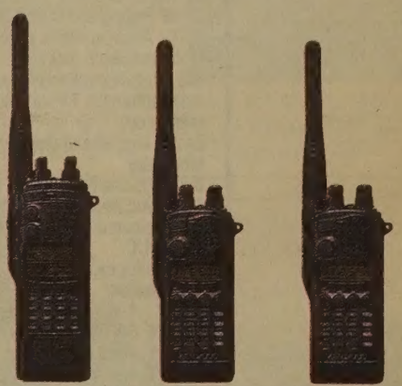
93-ARD-0596

KENWOOD

...pacesetter in Amateur Radio

To get the most out of handheld communications, choose Kenwood's TH-78A (144MHz/440MHz) which offers all the latest features. Or the TH-28A (144MHz) and TH-48A (440MHz) single-band transceivers, which are equally impressive. All three represent a winning combination of top-flight technology and ergonomic design.

- **Alphanumeric memory**
  Alphanumeric data (max. 6 characters) can be entered directly into memory.
- **Alphanumeric message paging**
  In addition to standard DTSS and paging functions, alphanumeric messages can be stored in memory for immediate transmission.
- **Dual-frequency receive**
  In addition to full-duplex cross-band operation, the TH-78A is equipped to receive two frequencies simultaneously, even on the same band. There's also independent double-band scan and ABC (automatic band change). The TH-28A and TH-48A feature dual-band receive capability, enabling semi-duplex cross-band operations (TH-28↔TH-48A).
- **Frequency coverage**
  TH-28A: 118-173.995 MHz, sub RX: 438-449.995 MHz; TH-48A: 438-449.995 MHz, sub RX: 136-173.995 MHz; TH-78A: 118-173.995, 438-449.995 MHz. Transmit on Amateur bands only. (MARS/CAP modifiable, permits required).
- **2.5W power with supplied battery pack**
  5W with 12 VDC power source (PB-14, PB-17, or external DC).
- **Non-volatile memory**
  The TH-78A has 50 memory channels (expandable to 250 with the ME-1 option), while the TH-28A and TH-48A have 40 channels (expandable to 240 with the ME-1 option).



TH-78A/28A/48A
FM Handheld Transceivers